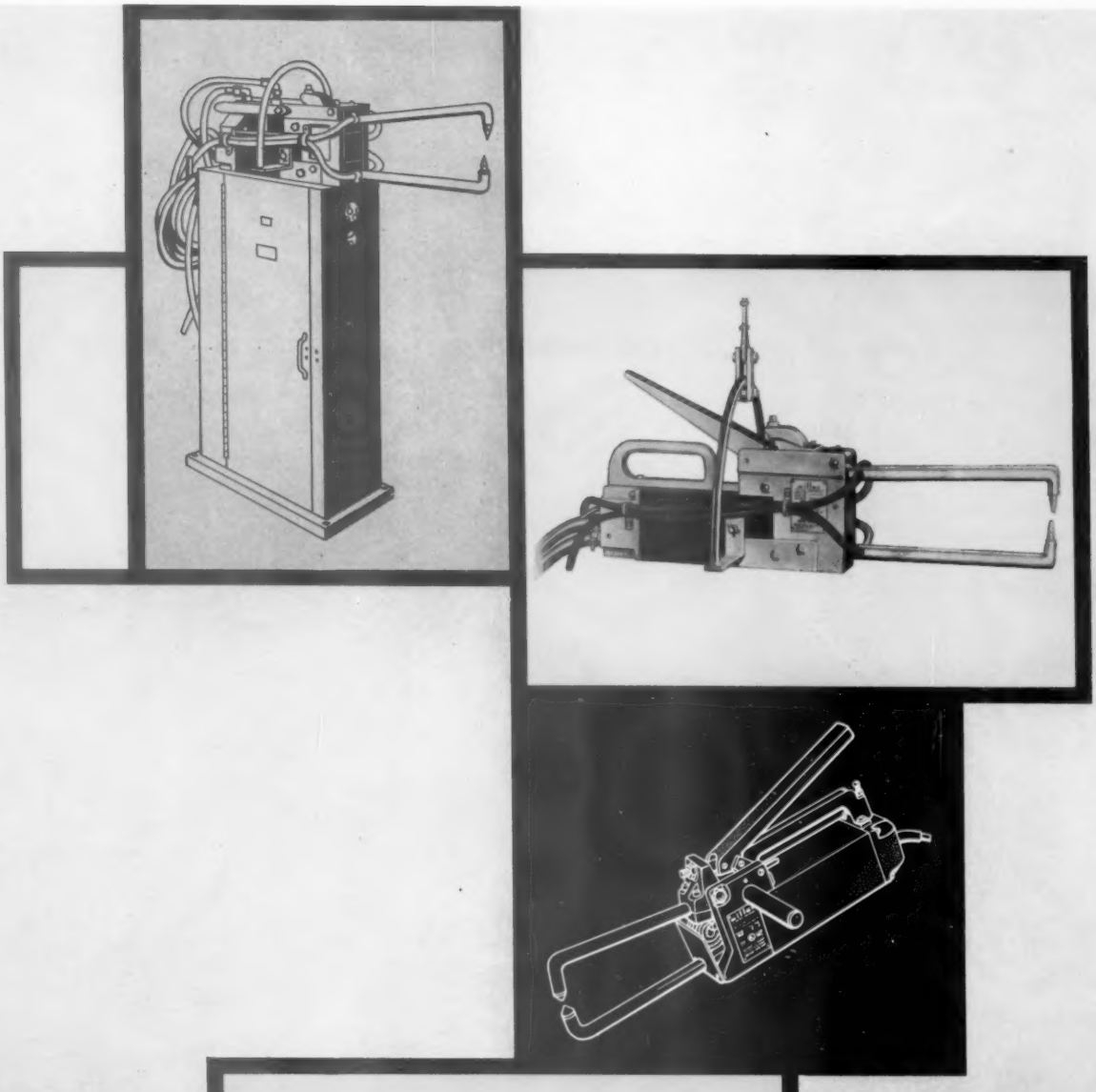
Welding Engineer

PRICE 50 CENTS

SEPTEMBER, 1957



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ELECTRIC MANUFACTURING CO., INC.
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Increased profits result when resistance welding replaces turn-of-the-century methods of fastening metals. From sheet metal shops to appliance and toy manufacturers, Miller spot welders have become industry standards. Available in a wide range of sizes from the 23-pound 1.5 KVA illustrated at bottom to the 20 KVA air-operated pedestal style shown at top. Center panel: 10 KVA manual model.

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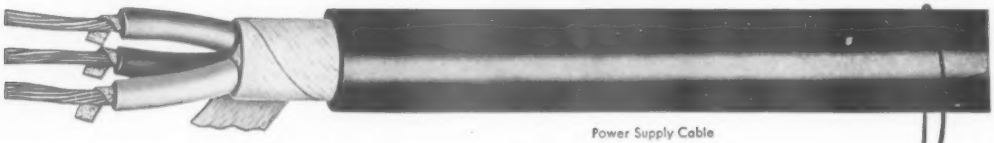

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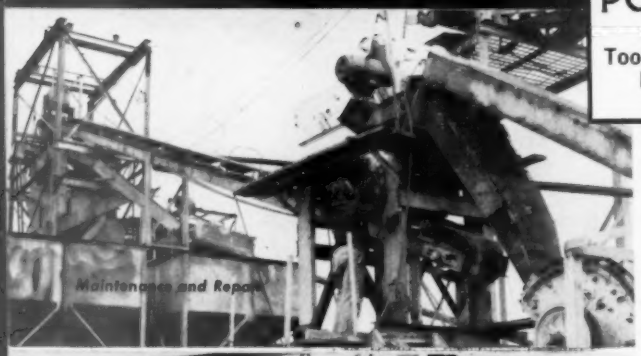
DO YOUR OWN WELDING

WELDS Anywhere. Construction Maintenance Repair

POWER to run Tools, Lights, Motors



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Built-in Idling Device

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110/220 Volt Outlets

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. . . and many other convenience "extras"

No more delays waiting on outside help for welding or power to run tools, lights, motors, etc.—or the extra cost of getting jobs done.

With this new Hobart, you can have your own welder, power combination and use your own men to do the work right on the job.

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Why not get the latest information on this new type welder — no obligation. Simply write HOBART BROTHERS Co., Box U-97, Troy, Ohio, or 'phone FE 2-1223.

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A size and type to meet every welding need

"One of the world's largest builders of arc welding equipment."

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HOBART'S NEW *All-Position Iron Powder Electrode*

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Would also like details on: 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐

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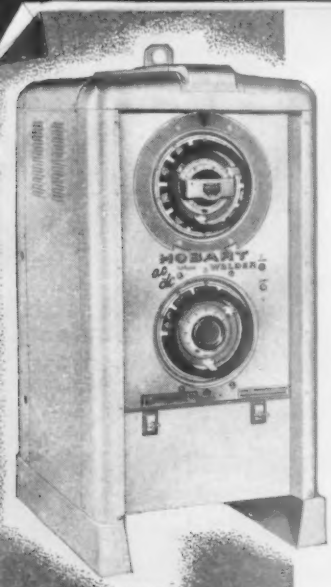

ac/dc welder combination

standard gas drive welder

standard elec. drive welder

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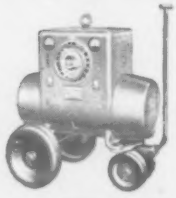

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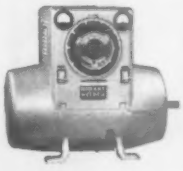
400-600 ampere



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200 ampere
combination

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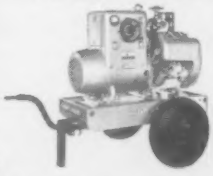
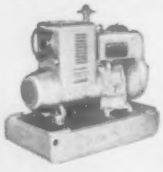


AC/AC WELDER
for AC Power or
AC Welding



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amp. size

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"BANTAM CHAMP"
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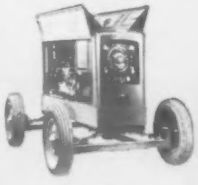
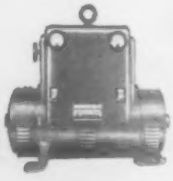
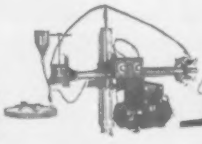


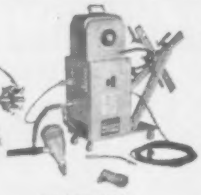
GAS DRIVE
Size 300-400
& 600 ampere



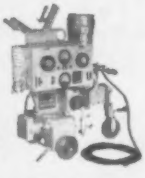
"POWROMATIC"
For automatic
arc welding



AUTOMATIC
Submerged
arc welding



HANDOMATIC
Semi-automatic
arc welding



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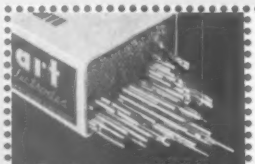
arc welding

HOBART BROTHERS CO., BOX U-972, TROY, OHIO

Phone FE 21223



Try the new Hobart Iron Powder Electrodes—keep pace with faster production and lower cost welding. They're specially designed for the "drag" technique.

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- ☐ Gas Drive
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- ☐ AC/DC Welder
- ☐ Automatic
- ☐ Semi-Automatic
- ☐ Iron Powder Electrodes

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Welding Engineer

SEPTEMBER, 1957
VOL. 42—No. 9

THE MAGAZINE OF JOINING
AND SEVERING OF MATERIALS

America's Pioneer publication which, combined with The Acetylene Journal, has been devoted to the interest of the welding and allied industries since 1898

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WELDING ENGINEER PUBLICATIONS, INC.
P.O. Box 28
Morton Grove, Ill.
Telephones:
ORchard 4-5130, IRving 8-3355

TED B. JEFFERSON
Editor and Publisher

FELIX T. TANCULA
Executive Editor

JACK FAIRLIE
Managing Editor

ROBERT KULAR *(M.E.)*
SHIRLEY GAGHEN
F. W. FOERSTE
Assistant Editors

ROBERT DAVIS, *Production*

JIM BREWSTER, *Circulation*

WARREN WARE
Western District Manager
P.O. Box 28
Morton Grove, Ill.
Telephones:
ORchard 4-5130, IRving 8-3355

HERMAN PHELPS
Eastern District Manager
P.O. Box 128, White Plains, N. Y.
Telephone: WHite Plains 9-3876

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Single copies 50 cents. Subscription rates: United States and possessions $3 per year; $4 for two years; $5 for three years. Canada $5 per year; $8 for two years; $10 for three years. All other countries $15 per year; $25 for two years; $30 for three years. Position and company affiliation must be indicated on subscription form. Allow one month for change of address.

Published monthly, with an additional directory number in June, by Welding Engineer Publications, Inc.

Entered as second class matter Aug. 23, 1948, at the Post Office at Chicago, Ill., under Act of March 3, 1879. Printed in U. S. A.

WELDING ENGINEER is indexed regularly by Engineering Index, Inc.

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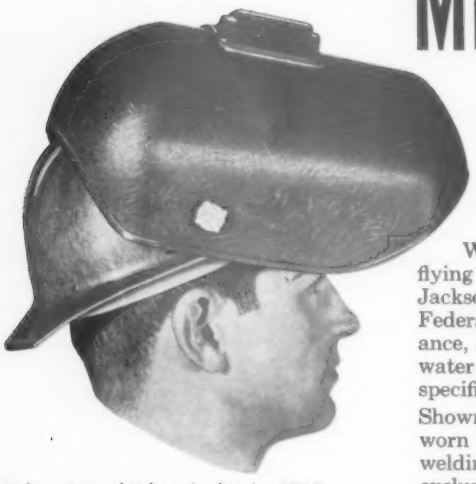


Jackson Cap and Helmet Combination SCH-1P

Here's Outstanding Head and Face Protection for Your Weldors under All Conditions

Wherever there's danger from falling or flying objects, protect your weldors with Jackson Safety Hats and Caps. They exceed Federal Specifications for electrical resistance, impact, penetration, flammability and water absorption. Weight is well below the specified limit.

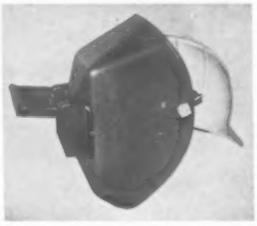
Shown at the left is the fiber glass safety cap, worn visor in back. The Jackson fiber glass welding helmet is shown held by Jackson's exclusive friction pivots with wing nuts, adjustable while helmet is worn.

New—All purpose Plastic Safety hats comply with Federal Specifications for construction workers' hats and Edison Institute requirements for linemen. The Life Guard cap, shown here, like Jackson's fiber glass safety caps, is also available in helmet and goggle combinations, and with Musketeer headgear and visors.

Jackson Helmet H1-AP

This Welding Helmet, with Adjust-O-Lok headgear and plastic lens holder is one of 18 models. Nylon, wear-resistant and insulative, is used for headband, friction pivots and large, winged knob adjusting mechanism.

Helmet shell is of fiber glass plastic. Strong, light, highly resistant to moisture, it holds its shape, lasts many times longer than old-style helmets. Lens holder, of high-impact plastic, is insulative, heat resistant. No metal parts protrude, so no current can pass shell or headgear.



Three styles of helmets are offered pivoted to the Jackson Safety Cap. Type SCH-4 shows white cap and narrow shell helmet, lift-front lens holder.

Type WR-70

The Supergoggles (shown left) are one of three series of Jackson Goggles. A true cover-all style, they're wider, without being bulky, to be worn over today's larger prescription glasses and safety spectacles. Larger inside areas, well ventilated, make them cooler, more comfortable.

Made with elastic headband or plastic headrest, for *gas welding*, or, with clear hardened lenses, for *chipping* and *grinding*.

Cap-and Goggle combination shows Unigoggle for gas welding. Springs in telescopic arms hold goggle up or down.

Musketeer Headgear with Visor No. 39

New Musketeer headgear, durable and convenient, has Nylon headband and pivots, both adjustable while in use. Cross strap adjusts to height; wide spark deflector carries a choice of visors. Shown: fiber visor with welding lens for scarfing. Also several sizes of plastic visors, clear or in shades of green, and a wire screen visor.

Hat and Face Shield combination has hinged visor 15½ x 9" in clear plastic or in shades of green.

JACKSON PRODUCTS

AIR REDUCTION SALES COMPANY, A DIVISION OF AIR REDUCTION COMPANY, INCORPORATED

WARREN • MICHIGAN

ABOVE: Movie star Conrad Nagel (right) interviews B. R. Russell on the "Men of Distinction" TV program. RIGHT: 40-ton jet fuselage section is pushed into Ryan hangar. (See stories below.)

News

Russell stars on TV show

B. R. Russell recently took the spotlight on the TV program "Men of Distinction." Russell, president of Airline Welding and Engineering, Hawthorne, Calif., told the success story of the firm he started from an idea. Movie actor Conrad Nagel was program moderator.

Men chosen for the show have contributed some important product or process to industry. The Horatio Alger-type story of Airline Welding was traced from the early days, when Russell made his first welding fixture out of scrap metal, to the latest large modern welding fixture being trial-tested in the plant.

Colored movies, 1,100 ft worth, were shot of Tig and Mig welding of aluminum, titanium and even 0.005 in. thick stainless 17-7 PH foil.

The program is scheduled to appear on 84 stations in this country and Hawaii in the next 10 months. Its length can be tailored from 12 to 30 minutes. Airline Welding's copy of the program will be shown to technical groups, including AWS, this fall and winter.

NCG gets rights to Swiss welder

Exclusive U. S. manufacturing rights to a Swiss machine that can weld standard railroad rails into one continuous quarter mile length in less than 2¼ hours have been granted to National Cylinder Gas Co., Chicago. (See p. 13, August WELDING ENGINEER.)

The arrangement covers rights in Canada, Mexico, Central America and most of South America. Production of the entire unit in this country is underway.

Continuous rails eliminate the "clickety-clack" of cars over rail gaps, reduce maintenance on cars damaged by uneven rail joints and eliminate wear on rail ends.

The rail flash resistance butt welder, first manufactured by H. A. Schlatter, can perform at a rate of 15 rail joint welds per hour. It takes no more than four minutes to put the rail sections in the machine, weld them, automatically shear off the weld burr and remove them. The entire unit fills three full-size railway freight cars.

Gamma rays to detect, control

Highly energetic gamma rays from radioactive cobalt are being used to detect and control the level of molten titanium in a new "cold hearth" arc furnace designed to prepare purified titanium. The titanium furnace with the new control is at the Westinghouse Electric plant at Blairsville, Pa.

To carry out the assignment, the penetrating gamma rays pass through as much as 15 in. of solid metal.

Ryan builds commercial giant jet fuselage

A giant, 40-ft, 3-ton aft fuselage section for this country's first commercial jet airliner has been built by Ryan Aeronautical Co., San Diego. The construction job was reported on p. 37 of the July WELDING ENGINEER.

At Boeing Airplane Co., Seattle, the section will be mated with other units of the 707 Jet Stratoliner.

Sonobond to sell ultrasonic units

Ultrasonic metal joining equipment developed by Aeroprojects Inc., W. Chester, Pa., will be manufactured, sold and serviced at the firm's new subsidiary, Sonobond Corp. Sonobond's formation was reported in the August *WeldWorld*.

The subsidiary was organized to assist industry in using ultrasonic non-fusion welding equipment, ultrasonic fluxless brazing equipment and soldering equipment.

"Sonoweld" is a new type of welding which joins metals and alloys by vibratory energy in about one second. Sonoweld can join thin foils, small wires. It can continuous-seam weld and spot weld in metals such as aluminum and copper and ranging in thickness from 0.0002 in. to 0.030 in., the firm reports.

Aeroprojects Vice President W. C. Potthoff is new president of Sonobond, also in W. Chester, Pa.

Pullman invades other fields

Pullman-Standard Car Mfg. Co., builder of railroad rolling stock, is organizing an industrial sales department for sub-contract work other than railroad equipment.

REFRIGERATOR frames are now spot welded with a Linde Mig spot welder torch in the Koch Refrigerators plant in Kansas City. Now the company turns out 35% more frames. Before, cabinets were fastened by a metal-screw method. (See story below.)

FIVE tons of scarifying rock plow is being fabricated for use in farming and land-clearing in Homestead, Fla. Jet 3/16-in. weld electrodes are used with the Caterpillar twin-arc welder. The plow will cut a 69 in. furrow.

Spot welding boosts production

With an old fabricating method, two men could produce seven refrigerators a day; with the new spot welding procedure, one man can produce 12 frames each day.

Koch Refrigerators Inc., Kansas City, reports it has upped production of refrigerator frames by 35% with Mig spot welding.

Shells of the cabinets had been fastened by a metal-screw method requiring punched and dimpled holes, inserting metal screws and vapor sealing the protruding screws. Spot welding eliminates these steps. Stainless steel sheets are lap spot-welded to galvanized steel sheets with a Linde spot welder and torch.

Southeast gets consulting service

Industrial and Utilities Specialty Co. has been organized to give southeastern industries a specialized consulting service on materials, tools and equipment. Firm headquarters will be in Chattanooga, Tenn. It will specialize in the welding, metallurgical and ceramic fields.

Starting the firm are E. J. McFadden, formerly general manager of Combustion Engineering Inc., and George L. Tepley, who was with C. D. Genter Co.

Canada's Carters get modern plant

Carter Bros., Ltd., recently moved into a $110,000 plant on Dearborn St., Waterloo, Ont., only 13 years after starting business in a 1,000 sq ft building.

Carter Bros. recently constructed the revolutionary welded aluminum bridge reported on page 29 of the July WELDING ENGINEER. The 180-ft long single span, all-welded conveyor bridge for a sand and gravel firm straddles the Grand River at Breslau.

Carter Brothers sell new truck bodies and make special aluminum bodies to specifications. The firm also operates a specially-built truck which distributes supplies to companies in the area.

Florida firm builds pipeline

A 60,000-barrel-a-day petroleum products pipeline from Port Everglades, Fla., to the Miami area will be built by Everglades Pipe Line Co., owned principally by the Buckeye Pipe Line Co. and Cities Service Co. It will serve the Miami area and Miami International Airport. The line will be 60 miles long and will cost about $4 million.

Half-year high in steelmaking

Steelmaking furnaces in the U.S. poured 60,586,145 net tons of ingots and steel for castings during the first half of this year—the second highest total for any half year says the American Iron and Steel Institute.

Greer Institute offers new welding course

Greer Technical Institute, Chicago, offers a new 18-month program in welding engineering beginning Sept. 30. The course was developed by the Institute and the Educational Activities Committee of the Chicago section of the American Welding Society.

Students successfully completing the course will receive a certificate of Welding Technician.

Air Products buys oxygen firm

Aldan Oxygen Mfg. Co., Philadelphia, has been purchased by Air Products, Inc., Allentown, Pa. According to Leonard P. Pool, president of Air Products, the acquisition permits the firm to extend its Cylinder Gas Division into the Philadelphia area. Manager of the firm will be E. J. Rosser, who founded the Aldan Co. in 1942.

High Voltage Corp. makes accelerator

The High Voltage Engineering Corp., Cambridge, Mass., is constructing a three million-volt Van de Graaff accelerator for the University of Maryland's research program in nuclear physics. The school was recently awarded a contract of $250,180 to carry on the combined experimental and theoretical program. The basic research tool will be the accelerator, to be installed in June, 1958.

Tube Turns hits 30th year

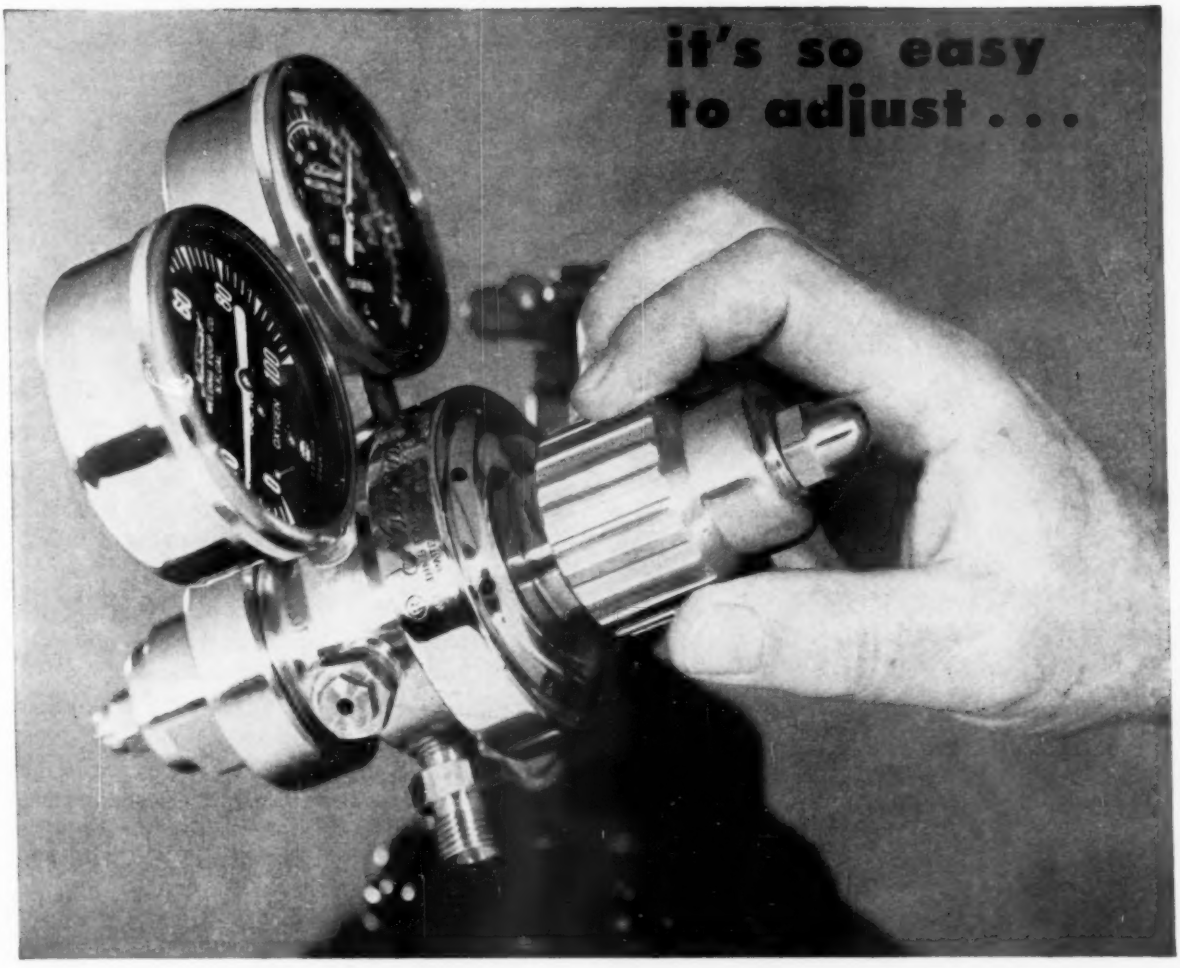
Tube Turns, Louisville, Ky., manufacturers of welding fittings and flanges for industrial piping systems, celebrated its 30th anniversary recently.

Branch plants have been established in Los Angeles, Houston and Ridgetown, Ontario.

Michigan bridges rise rapidly

By end welding stud shear connectors in the field, the shear developers for decks of composite steel-and-concrete bridges in Michigan are being

(Continued on page 101)



just touch the adjusting screw — you will love the freedom of action — the instant response

The first time you touch the adjusting screw of this regulator you will be utterly amazed at its easy action.

Such adjustability and working accuracy suggests the wonderful care taken in the designing and manufacturing of this precision instrument — and one glance at the beautiful appearance shows quality throughout.

National of . . . california

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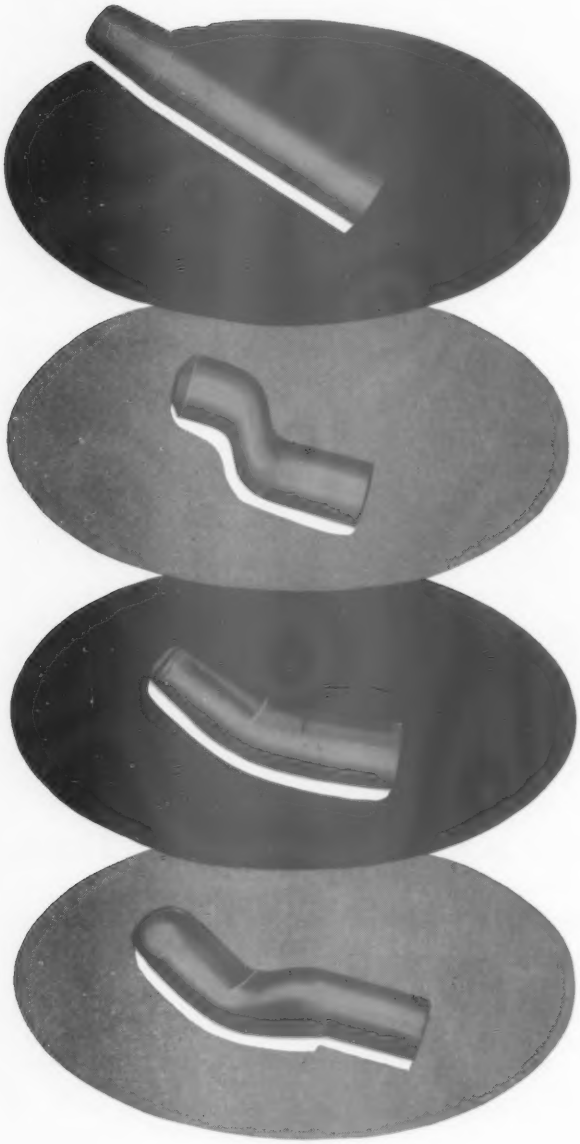
517

If You Use Resistance Welding...

Take A Tip From Mallory



Mallory resistance welding electrodes are available in the widest variety of stock sizes and shapes to be found anywhere. Many of the Mallory standards can actually eliminate the need for costly special electrodes. Constant Mallory research and pioneer background in the field of alloys continues to contribute increased life and better performance to a growing number of diversified users.

FAST DELIVERY is a product of a large and well rounded stock of standard electrodes. Mallory's diversified stock enables changeover and replacement units to be shipped to you on short notice.

LOWER COSTS are your benefit—brought about by the broad line of standard electrodes which often eliminate custom-built costs; and by Mallory's continuous effort to increase life and improve performance.

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Harris "L" type regulators permit setting the pressures as required for maximum economy and safety, with removable adjusting keys.

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- Outstanding ability to preheat quickly
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COMPLETE PROPANE CUTTING UNIT, 62-2F/L-92

62-2F 90° (or 62-2AF 70° head) cutting torch
LX-92-SC lock type oxygen regulator
L-92-SC-P lock type propane regulator
6290-NFF extra fast preheat cutting tips available in sizes from **000-NFF to 6-NFF**

Similar equipment available for natural gas. Information on request.

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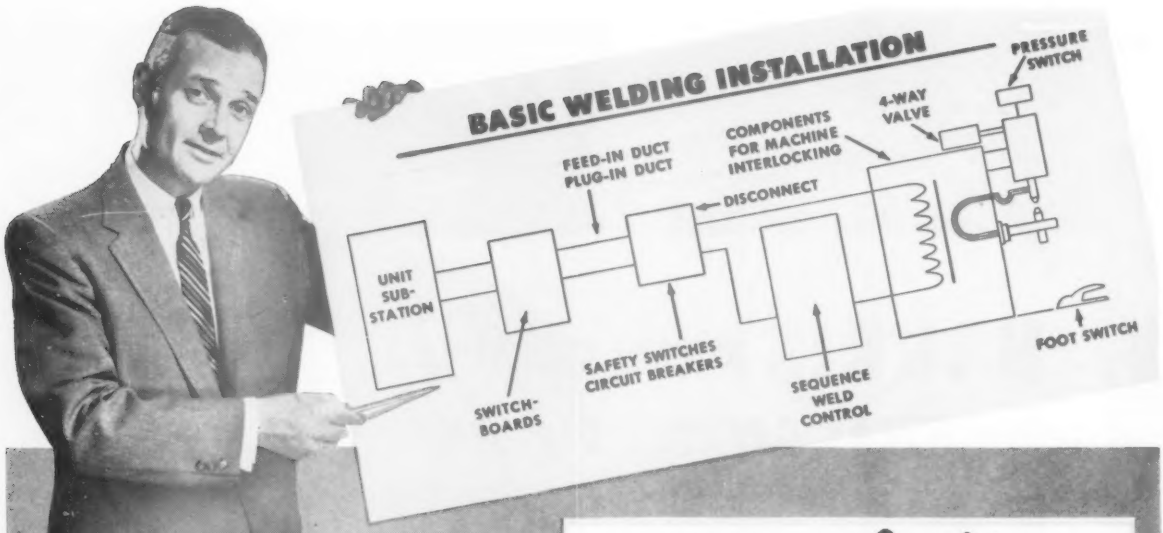

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Field Engineers are available through Square D branch offices in all principal United States cities—and in Canada, Mexico and England. Backing up these engineers are the design and manufacturing facilities of 14 strategically located Square D factories and the localized services of a nation-wide network of authorized electrical distributors.

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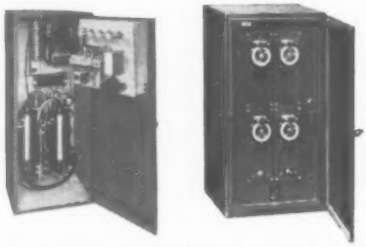

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at press time

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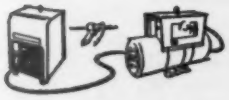


. . Liquid Carbonic Corp., Chicago, will probably be known as a division of General Dynamics Corp., New York City, when a proposed share-for-share exchange is made between the firms. Liquid is top producer of carbon dioxide and fourth largest manufacturer of oxygen and acetylene. General Dynamics is composed of such firms as Electric Boat Div., builder of the first atomic submarines, Convair Div., and Stromberg-Carlson Co.

. . Integrated body-frame weldment, not exactly new in automobile construction (Nash pioneered it), has been adopted by Lincoln division of Ford. It is also finding its way into manufacture of other autos. Among them: a sports car.

. . Oxygen and acetylene prices went up last month. Linde Co. raised oxygen 7 cents per 100 cu ft in cylinders, although bulk oxygen on tonnage basis remains as before. Acetylene went up 25 cents per 100 cu ft. Other gas manufacturers followed suit shortly afterwards.

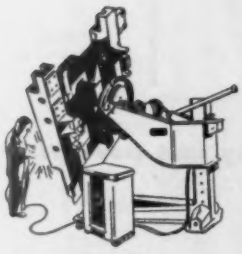
. . Look for more cold welding applications in automobile industry. Steel frames and aluminum radiators are two components on which the process will soon be used. Detroit is also using more CO_2 automatic set-ups. Welding Engineer will carry story on latter in near future.

. . Industry expects aluminum prices to go up any day . . . to about 26 cents for pig. Blame is laid on rising costs, not demand, which is down. Wage boost last month is one contributing factor.

. . If you're in a business that depends greatly on military orders, look for a cutback. Proposed Defense Dept. reductions are said to be legitimate, will affect many industries.

. . Cobalt 60 prices went down last month. Atomic Energy Commission hopes new prices ($2 to $5 per curie) will encourage wider use of radioisotope in industrial and research applications.

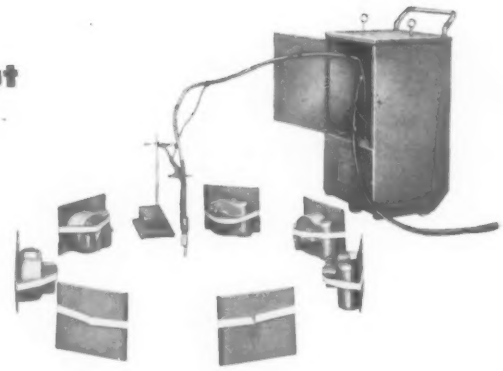
. . Fast write-off on taxes seems doomed. Senate finance committee voted to kill it in 2½ years, has limited it greatly during that term.



. . Copper took another setback in August when Phelps Dodge Corp. and Kennecott Copper Co., largest U. S. producers, cut prices 3/4 of a cent per pound. New price of 28½ cents, down 17⅞ cents over the period February—July, 1956, may counter falling demands. Other copper producers undoubtedly will follow the leaders in chopping prices.

some people have queer notions about

RADIOGRAPHY WITH ISOTOPES



Here's a typical multiple-specimen setup . . . seven castings radiographed simultaneously with a T.O. model 402 panoramic Cobalt 60 unit.

Many a plant, uneasily aware that it is missing the profits of radiographic inspection, still holds back for one mistaken "reason" or another. Here are some we run into . . .

"out of my league" . . . *costs too much*

Not so. An iridium 192 machine costing as little as $1700 may be fully adequate to your needs. *Indeed, average equipment cost is less than $2500.*

needs a *specialist* to run

On the contrary, a practical on-the-job training course in our Cleveland laboratory (free tuition to buyers) equips any intelligent employee with all he has to know.

takes forever to make a radiograph

Not so. You can x-ray 1" steel in 30 seconds, 3" sections in 4 minutes with the Cobalt 60 sources available today.

gamma radiographs are no good

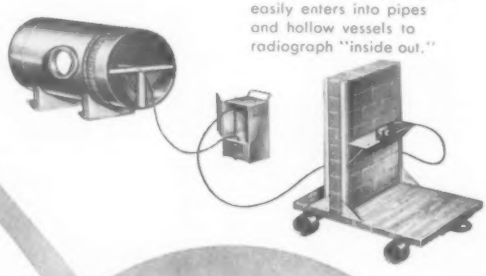
Not so. If you use the right source for the right job you'll have no trouble getting the 2% detail sensitivity required by exacting inspection codes.

it's dangerous; we're afraid of it

No reason to be: Technical Operations modern equipment is safe and simple-to-handle.

not for me; my stuff is different

We don't know what *your* business is . . . but if *whatever* you make (or buy or sell) needs "seeing into" for quality control, radiography (either gamma or x-ray) can profit you as it does others — *your competitors included.*



The compact source capsule easily enters into pipes and hollow vessels to radiograph "inside out."

costs nothing to find out

what radiography can do for you. Simply call in your local Picker representative* or write us outlining your problem (and if possible, sending typical samples). We'll make tests and tell you frankly whether radiography holds any promise for you. Because Picker offers *both* x-ray and isotope equipment, we have no axe to grind for any particular method.

There's probably a Picker district office near you (see local 'phone book)

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25 South Broadway, White Plains, N. Y.

SOME OF THE TECHNICAL OPERATIONS GAMMA RADIOGRAPHY UNITS MARKETED AND SERVICED BY PICKER X-RAY

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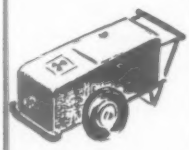
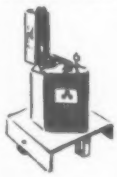
TO402
Cobalt 60 Unit

TO404
Cobalt 60 Unit



TO446
Cobalt 60 Unit

TO405
Iridium 192 Unit



TO416
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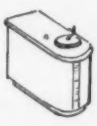
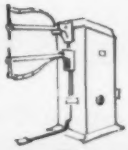

Arc Welding Equipment


Spot Welding Equipment

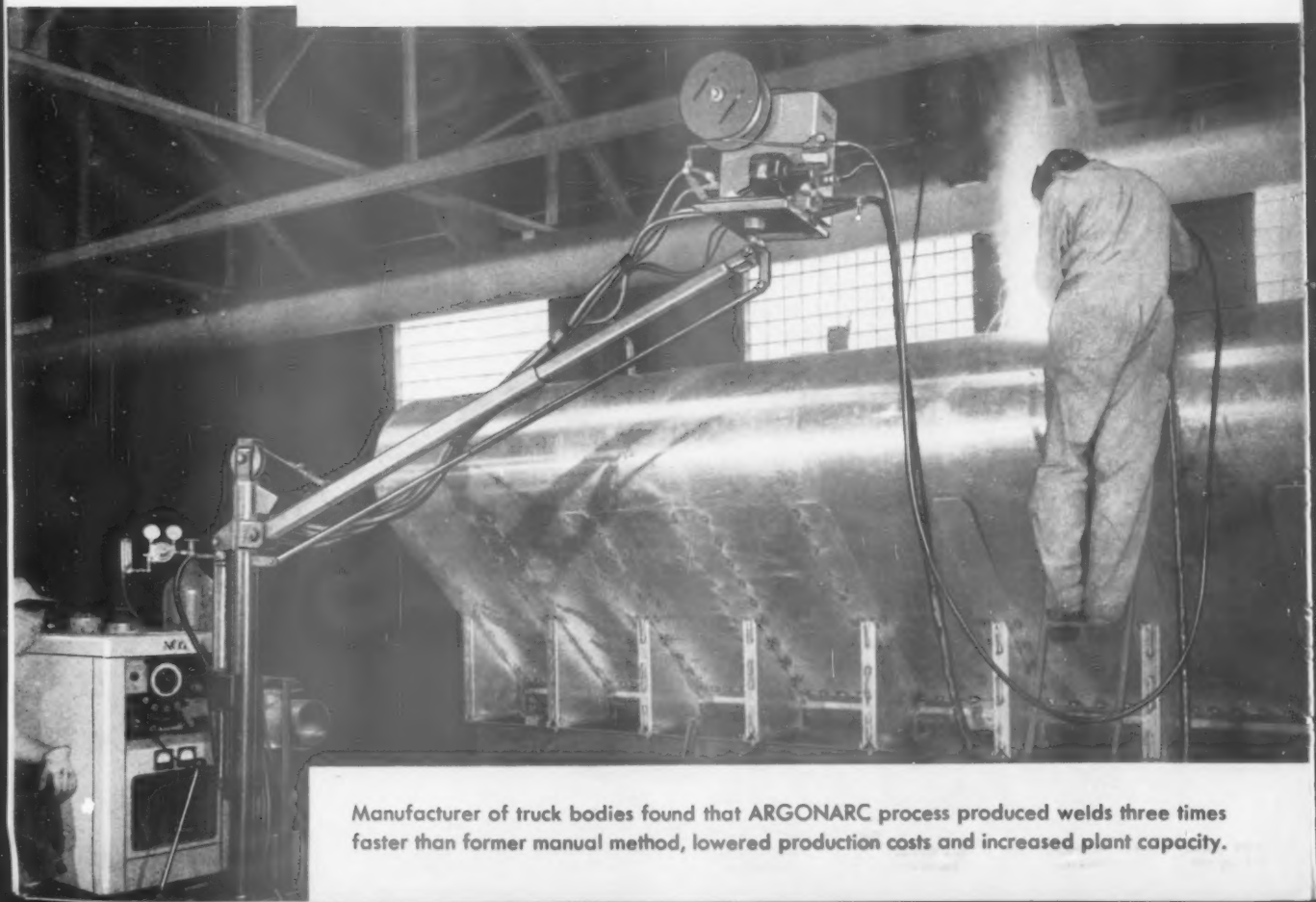
Soldering, Brazing Equipment

Safety Equipment

Cutting Equipment

Accessories

Fabricator of gasoline storage tanks reports that DUAL SHIELD process has reduced welding costs by 25 per cent.



Manufacturer of truck bodies found that ARGONARC process produced welds three times faster than former manual method, lowered production costs and increased plant capacity.

Now! Better Welds at lower costs than ever before possible

If the cost of welding is a major factor in your operations, here is news that can have an important bearing on your future profits.

Two new NCG welding processes—DUAL SHIELD* for mild steel and ARGONARC* for stainless steel and all other weldable metals—have proved in actual use that they can reduce welding costs to record-breaking low levels.

Both processes use the same NCG equipment—basically a control and wire drive unit used either with the NCG Automanual* welding gun or the NCG automatic torch. DUAL SHIELD welding is done with a coiled flux-cored electrode, with CO_2 as a shielding gas. ARGONARC welding uses coiled welding wire and argon as the shielding gas.

Using the Automanual welding gun with DUAL SHIELD electrode, a weldor can deposit from four to five times as much weld metal as with conventional manual electrodes. Penetration is deeper, welds are of high quality and slag is practically self-removing. The ARGONARC process offers comparable advantages. In both processes, welding efficiency is further increased by using the automatic torch.

Ask the NCG office in your area to show you what these new processes are doing for others. Or write for informative literature.

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. . . and every shot A WINNER!

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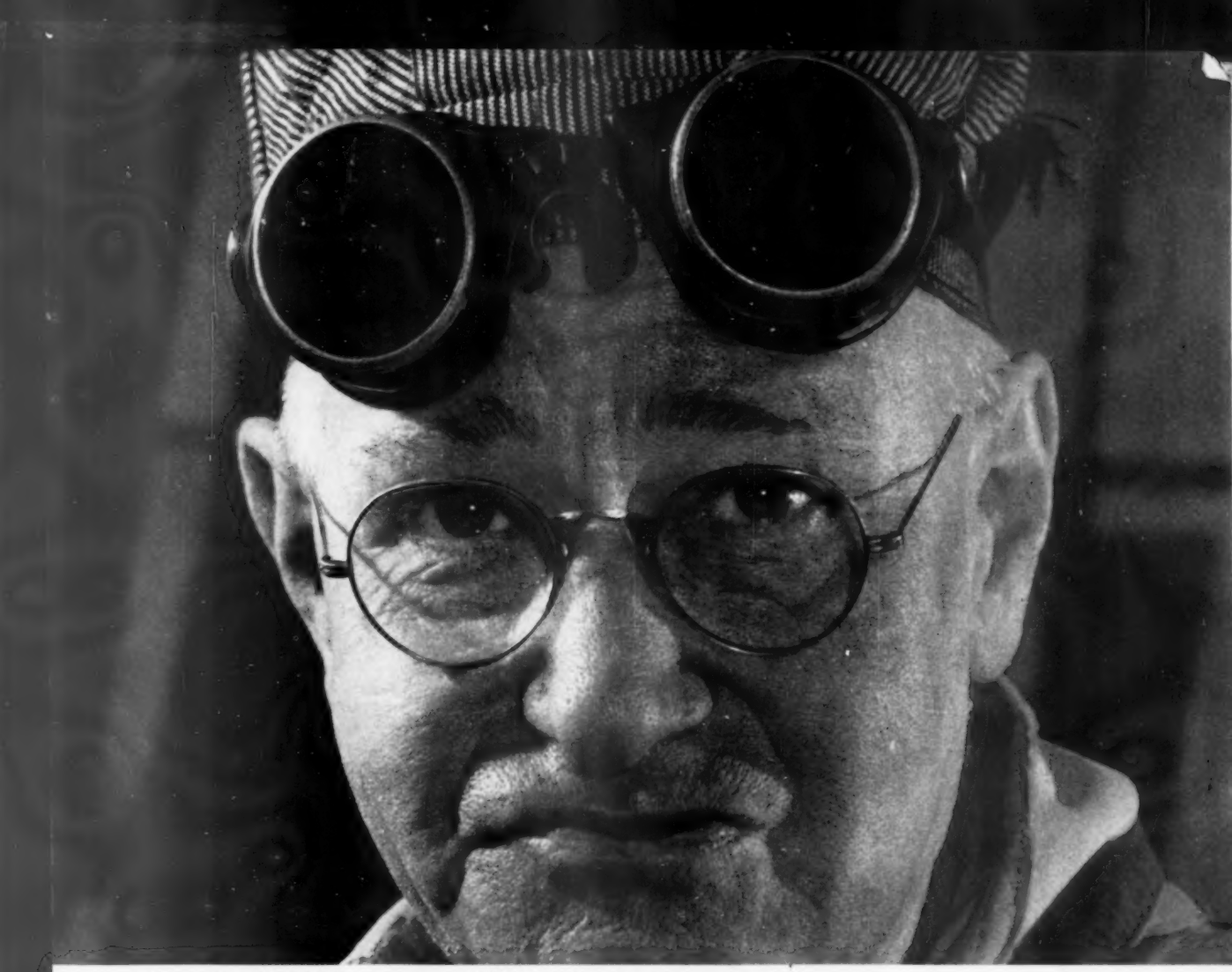
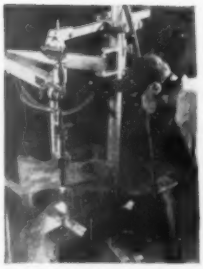


George W. Rabe, Welding Foreman at Wilmot Engineering Co., says:

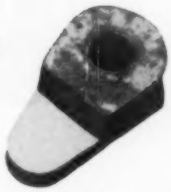
"When it comes to cutting, our #42 Camograph is a jack-of-all-trades"



Unerring Accuracy. Permanently magnetized tracer hugs steel template. Knurled roller follows most intricate shapes at constant speed.

The Airco #42 Camograph shown at left has eliminated much of the manual flame cutting operations in the White Haven, Pa., plant of the Wilmot Engineering Company. Welding Foreman, George W. Rabe, appreciates the way it can be set up, leveled and put to work anywhere in the shop in just a matter of minutes. Accurate Camograph shape cutting reduces the need for machining of many parts including sprockets, lugs and shaft arms. It is often used for moderate production runs of identical pieces.

Learn more about the versatile #42 Camograph and put its many time and labor saving features to work for you. Contact your nearest Airco office or call your local Authorized Airco Dealer for details. Ask for Catalog ADC 853.



Three cuts by the #42 Camograph eliminated extensive machining to produce this intricate piece.

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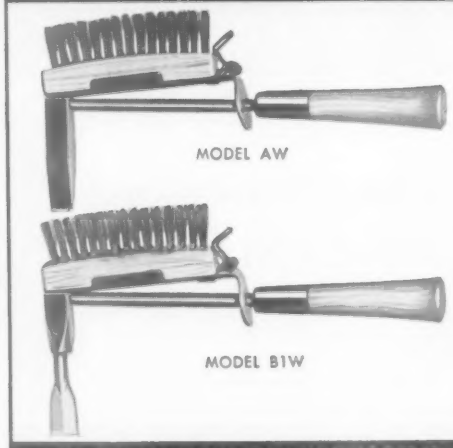

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707 E. LEWISTON AVENUE, FERNDALE 20 (DETROIT) MICH.

Letters should be addressed to: The Editor, WELDING ENGINEER, P. O. Box 28, Morton Grove, Ill. No letter will be published unless signed, but your name will be withheld if requested.

Expands with industry

Dear Sir: *E. Pittsburgh*

Please accept my congratulations and best wishes for your success in your new location. It looks like the WELDING ENGINEER is expanding like the welding activity it promotes.

In the past I have told you personally how I enjoy your courageous and forthright editorials. I consider the one in the July issue one of these.

I got a kick out of the reference to "Overseas Visitors" on page 21 of your July issue about the quotation "the British have the edge" in regards to American advertising originality. In my AWS and Westinghouse activities I get amusement, at times, from the steadfast opinions which I encounter from our British contacts. I also enjoyed the article "Iron powder electrodes," particularly in the February and July issues of the WELDING ENGINEER.

J. W. Kehoe
Westinghouse Electric Corp.

Fact File issue

Dear Sir: *Basel, Switzerland*

I just reviewed the Fact File issue of the WELDING ENGINEER and I would like to congratulate you sincerely for this very fine work which seems to me to be the most concentrated information on the welding branch of any country in the world.

Dr. C. G. Keel
Editor, *Swiss Welding Journal*

In error

Dear Sir: *San Diego*

I note from page 5 of the WELDING ENGINEER for July that Weldaloy Products Co. is "reportedly the first copper alloying firm to move west." I have been doing business with Ampco's branch, in Burbank, since early 1947. (The branch has been there for the last 14 years, and has been producing various grades of high-electrical conductivity alloys.)

H. E. Bailey
Bailey Equipment Co.

USS TECHNICAL WELDING DATA

3

Effect of Welding on Notch Toughness of USS "T-1" Steel

THE EFFECT OF WELDING on the notch toughness of steel is normally determined by Kinzel-type notch-bend tests on welded and unwelded plate in the quenched and tempered condition. Details of the welded plate specimen are shown in Figure 1. The unwelded specimens are identical to the welded, except for the omission of the weld. The plate temperature prior to welding is 70° F., and after welding, the specimens are aged at 50-80° F. for a minimum of three weeks. The specimens in sets of about 25 are then bent at various temperatures with the weld bead in tension as shown in Figure 1. In general, three specimens are tested at each temperature.

INFORMATION DETERMINED FOR EACH SPECIMEN TESTED

1. Total (maximum) angle of bend and angle of bend at maximum load. Obtained from deflection-angle curve.
2. Fracture mode expressed as per cent shear. Obtained by observation of fracture.

The data obtained are plotted on the basis of testing temperature, and envelopes are drawn around the plotted points to indicate the amount of scatter. The curves for ½"-thick USS "T-1" Steel plate welded with E-12015 electrodes are shown in Figure 2. The data are for specimens taken longitudinal to the final rolling direction of the plate.

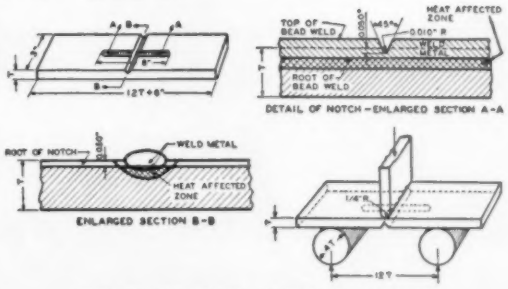
TO DETERMINE DUCTILITY-TRANSITION TEMPERATURES, the middle of the temperature range in which the total angle of bend drops rapidly to a low value is chosen. This is the temperature at the middle of the "scatter band" in the angle of bend curve in Figure 2.

THE FRACTURE-APPEARANCE-TRANSITION TEMPERATURE is also determined. As used here it is the temperature at which 50% of the fracture occurs in the shear mode, i.e., 50% of the fracture is fibrous. Typical curves are shown in Figure 2.

The results of notch-toughness studies on ½"-thick plate are given in the Summary, below. The Summary includes data for Regular Quality plate as well as data for Firebox Quality plate.

It should always be borne in mind that at the present time there is no absolute correlation between transition temperature as obtained experimentally with the various types of specimen and service performances. *Results obtained from the same types of tests on different steels should be very useful in establishing the relative merit of the steels.*

REMEMBER THIS: No other alloy steel offers the combination of properties that "T-1" Steel possesses. Here, in just one steel, you get very high yield strength (90,000 psi minimum), extraordinary toughness, great resistance to impact abrasion, and good high temperature strength. These let you reduce the size of highly stressed parts . . . save weight, reduce the amount of welding required and cut your costs. USS "T-1" Steel is being used in bridges, excavating equipment, pressure vessels, towers . . . in equipment that must take heavy abuse in sub-freezing temperatures . . . in equipment that must withstand heavy stresses and impact abrasion at temperatures as high as 900° F.



WELDING CONDITIONS: electrode diameter 3/16"; current (amps) 180; voltage 27; speed of travel (in./min.) 6.0; heat input (watt sec./in.) 48,000.

Fig. 1. Details of Kinzel-type notch-bend specimen and of testing jig.

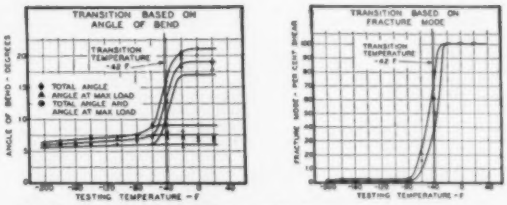

TRANSITION BASED ON ANGLE OF BEND
TRANSITION TEMPERATURE -62 F
TOTAL ANGLE
ANGLE AT MAX LOAD
TOTAL ANGLE AND ANGLE AT MAX LOAD
ANGLE OF BEND - DEGREES
TESTING TEMPERATURE - F
TRANSITION BASED ON FRACTURE MODE
TRANSITION TEMPERATURE -62 F
FRACTURE MODE - PER CENT SHEAR
TESTING TEMPERATURE - F

Fig. 2. Measurements and transition-temperature selection criteria in Kinzel-type notch-bend test.

Summary of notch-toughness test data on ½" USS "T-1" Steel plate (heat No. 74L236)

Test	Type of Plate	Specimen Orientation	Specimen Condition	Ductility-Transition temp., °F.*	Fracture-Appearance-Transition temp., °F.**
Kinzel notch-bend	Firebox Quality	Long.	Unwelded	minus 68	minus 67
Kinzel notch-bend	Firebox Quality	Trans.	Unwelded	minus 62	minus 59
Kinzel notch-bend	Regular Quality	Long.	Unwelded	minus 130	minus 128
Kinzel notch-bend	Regular Quality	Trans.	Unwelded	minus 91	minus 91
Kinzel notch-bend	Firebox Quality	Long.	Welded†	minus 42	minus 42
Kinzel notch-bend	Firebox Quality	Trans.	Welded†	minus 50	minus 47
Kinzel notch-bend	Regular Quality	Long.	Welded†	minus 92	minus 89
Kinzel notch-bend	Regular Quality	Trans.	Welded†	minus 112	minus 112
Kinzel notch-bend	Firebox Quality	Long.	Welded and stress-relieved‡	minus 30	minus 27

* *Taken at middle of bend*
** *Selected at 50% shear*
† *E12015 electrodes*
‡ *E9015 electrodes; Stress-relieved at 1100°F. for 1 hr.*

FOR COMPLETE INFORMATION about the application and fabrication of USS "T-1" Steel, write for our new comprehensive booklet to United States Steel, Room 2801, 525 William Penn Place, Pittsburgh 30, Pa.

USS "T-1" CONSTRUCTIONAL ALLOY STEEL

"USS" and "T-1" are registered trademarks

United States Steel Corporation, Pittsburgh
Columbia-Geneva Steel Division, San Francisco
Tennessee Coal & Iron Division, Fairfield, Ala.
United States Steel Supply Division, Warehouse Distributors, Coast-to-Coast
United States Steel Export Company, New York

UNITED STATES STEEL

WELDING CABLE

IF IT CARRIES CURRENT, KW CARRIES IT!

LIGHTEST WELDING CABLE EVER MADE:

REDUCES FATIGUE, GETS MORE WORK DONE

Made of Kaiser Aluminum . . . one third the weight of copper cable

Ask the man who's worked with both. *He'll* tell you there's a difference!

He'll tell you that lightweight KW welding cable is easier to lift . . . easier to drag around.

He knows what this means when he's on the job—in greater freedom, greater efficiency.

And, for more energy left after a day's work, he'll tell you KW's light weight helps plenty!

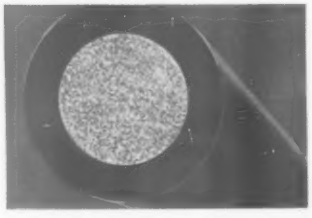
Then . . . compare KW's price and ask YOURSELF this question: "Isn't KW aluminum welding cable the most practical answer of all for MY welding cable problems?"

KW welding cable is produced for equipment manufacturers by Kaiser Aluminum at the company's Newark, Ohio wire and cable mill. For complete information, contact your welding equipment manufacturer or supplier.

Kaiser Aluminum & Chemical Sales, Inc., *Executive Office*, Kaiser Building, Oakland 12, California; *General Sales Office*, Palmolive Building, Chicago 11, Illinois.

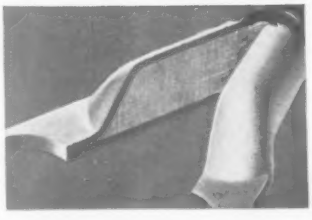
Yet that's only part of the story . . .

FLEXIBLE to make work easier! KW cable is so flexible that it can easily be looped with thumb and forefinger. The fine aluminum wires used assure maximum flexibility—plus toughness and long-life durability.



DURABLE to withstand hard use! KW's tough GRS rubber jacket resists abrasion, acids, sunlight and heat. For extremely hard usage, KW's fireproof neoprene jacket offers maximum resistance to abrasion, acids, alkalies, grease, oil, sunlight, heat.

RUNS FAR COOLER! Aluminum dissipates heat faster than copper cable of equivalent size. As a result, an aluminum cable is cooler and more comfortable to handle.



EASY TO SOLDER to make good connections! Both soldered and mechanical connections are simple to make with KW aluminum welding cable—whether aluminum to aluminum or aluminum to copper in cables, terminals and accessories.

Kaiser Aluminum

IF IT CARRIES CURRENT, K/W CARRIES IT!

Powder-washing with the
OXWELD C-62 Blowpipe—fast,
efficient, economical.

Another Foundry Goes Modern!

No costly, time-consuming chipping and grinding here.

This foundry has gone modern . . . with powder-washing.

Powder-washing is the fastest, most efficient way to remove fins, pads, sand inclusions, and other defects from casting surfaces.

THE RESULT? *Increased production and profits!*

Call your nearby LINDE representative or write for more information today.

LINDE COMPANY DIVISION OF **UNION CARBIDE** CORPORATION

30 East 42nd Street, New York 17, N. Y.

"Linde," "Oxweld," and "Union Carbide" are registered trade-marks of Union Carbide Corporation.

BETWEEN PASSES

our entry: taxes

A competition is being conducted to find what the best informed opinion of the Free World regards as *the most important economic problem to be faced by the United States in the next 20 years.* The sponsor: the Committee for Economic Development, New York City, with an assist from the Ford Foundation. Numerous $500 awards will be made. Our entry: excessive taxation, which is already here, but will become worse in the next two decades unless it is reversed, and pronto!

steel and oxygen

The American Iron and Steel Institute reported recently that nearly half of all oxygen produced in the United States last year was consumed by the iron and steel industry. Output—including high-purity and tonnage oxygen—was 49,300,000,000 cu ft, of which 23,901,000,000 cu ft was used in promoting chemical reactions in producing steel. That figures out to a whopping 2.7 million cu ft per hour. Although most of the total was purchased from off-site oxygen facilities, about one third of the industry's consumption came from on-site plants.

so help me

Sept. 9-15 is *Lessons in Truth Week.* This is nothing to laugh at. Many of us could stand a refresher in such a curriculum. But our favorite week during this month is the one that runs from Sept. 16 to Sept. 21. These six days will proclaim to the world the United States' most recent contribution to world culture—*Rock 'n Roll* . . . ugh!

helium for satellite

Vanguard—the first man-made earth satellite—will get some help from helium when it begins its flight beyond the pull of gravity. Helium (best known to our industry as a shielding gas) will be used in pressurizing liquid-propellant tanks for the second-stage rocket engine of the satellite's launching vehicle. The pressurizer must be inert so it will not react with propellants. Helium won over nitrogen—the other cheap and plentiful inert gas—because it is far lighter. National Cylinder Gas Co., Chicago, is supplying the helium to Aerojet-General Corp., Los Angeles, builder of the second-stage propulsion system for Vanguard. Incidentally, the International Geophysical year began July 1 and will run 18 months through Dec. 31, 1958. Vanguard is to be launched during this time.

education

The Resistance Welder Manufacturers' Association has collaborated with the International Correspondence Schools in formulating a "Resistance Welding Technology Course." Almost four years in the making, the course has been completed for release to members and affiliates of RWMA, and to users of resistance welders. The I.C.S. course is primarily intended for training technicians and operators . . . newcomers as well as those already in the field. In bringing production line students up to the technician level, the course will also help release those engineers now doing r-w work for other engineering tasks.

automated design

Automation has entered the welded design field. Automatic computing methods in designing its standard H-section welded trusses have been adopted by The Austin Co., Cleveland. An IBM magnetic drum data processing machine can process in 15 minutes as much truss-loading data as one engineer can prepare in about two months. Austin expects to investigate wider use of electronic computers to obtain data pertaining to solutions of other engineering problems.

a reminder

. . . for those who keep writing us at our old address. *WE* and *The Welding Distributor* are now headquartered in the new Welding Foundation Building, located in Morton Grove, Ill. Our new site is pictured above. Mailing address is P. O. Box 28.

flame-cut sign

The first thing a visitor to our new offices sees when he opens the door is the flame-cut steel sign pictured above. It hangs in our reception room. Shows we practice what we preach . . . although we actually didn't "practice" it. The sign was cut for us by H. L. McElhoe, a district manager for Smith Welding Equipment Corp., Minneapolis. A true artist with the torch, McElhoe used no template . . . didn't even sketch the words first.

NEW Airco POP can seals out dampness...

keeps stainless steel electrodes "oven fresh" in re-usable aluminum container — eliminates special storage facilities!

Airco Stainless Steel Electrodes are now packed in seamless aluminum containers. Each "POP" can contains 10 pounds of electrodes, and is sealed with a waterproof airtight industrial tape.

This hermetic electrode packaging technique is the best way to keep stainless steel electrodes "oven fresh"—without benefit of special shop or field storage equipment. Unused electrodes can be kept fresh by resealing the can.

Airco Stainless Steel Electrodes, in the "POP" can, are but one of many types in Airco's complete line that also includes hard-facing, cast iron, mild steel, general, and special purpose electrodes. Send for the free Airco Electrode Guide which will help you select the right electrode for your special job.

AT THE FRONTIERS OF welding PROGRESS YOU'LL FIND...

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A division of Air Reduction Company, Incorporated
150 East 42nd Street, New York 17, N. Y.

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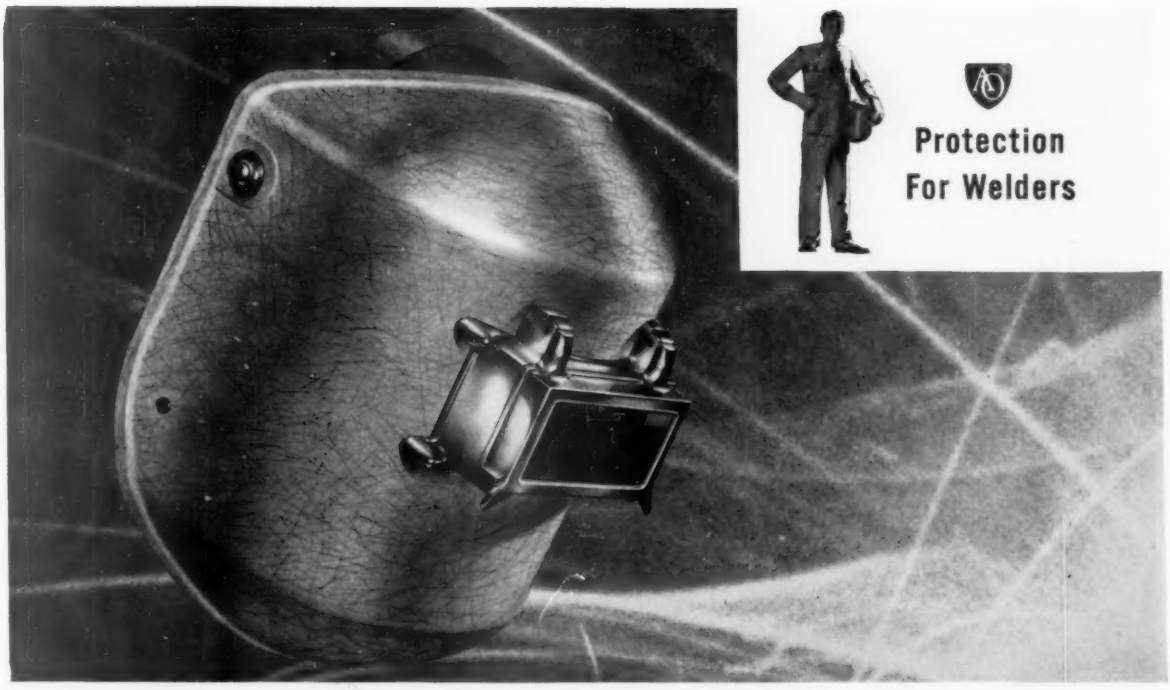
Products of the divisions of Air Reduction Company, Incorporated, include: **AIRCO** — industrial gases, welding and cutting equipment, and acetylenic chemicals • **PURECO** — carbon dioxide — gaseous, liquid, solid ("DRY-ICE") • **OHIO** — medical gases and hospital equipment • **NATIONAL CARBIDE** — pipeline acetylene and calcium carbide • **COLTON** — polyvinyl acetate, alcohols, and other synthetic resins.



Protection For Welders

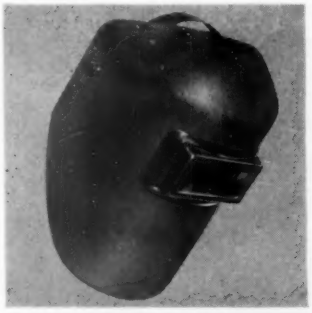
AO "Weld-Cool" the First

WHITE FIBER GLASS WELDING HELMET

. . . Cooler — Reflects 70% of Radiant Heat

Here's the answer to the plea of welders for a cooler helmet . . . AO 9702-W and AO 9706-W Weld-Cool Helmets made of Fiber Glass. Because these helmets reflect 70% of radiant heat from their white exterior surface, welders are 50% cooler and far more comfortable . . . more efficient also! Aluminized plastic coverplate, AO 168AL also available . . . provides exceptional coolness in eye area. Helmet is black inside to eliminate any possibility of diffusion of harmful light rays and to permit easy cleaning. Reflective, cool, aluminum glass holder. All helmets flame resistant. Stationary or lift front. Also available with dark gray shell as No. 9702 or No. 9706.

Quick Facts — *New plastic*, easy floating, rear adjustment, positive lock headgear — locks securely once set to proper head size. • Adjustable friction joint • Exceptional ventilation • Adjustable vulcanized fiber chin rest for easy alignment of helmet in line of vision • Lightweight, exceptionally strong • Nonwarping and moistureproof, particularly recommended for inert gas, shielded arc and outdoor welding.



PREFER VULCANIZED FIBER?

AO Presents 4 Welding Helmets made for the Job!

All 4 helmets have rear positive lock adjustment, adjustable chin strap and friction joints identical to AO Fiber Glass Helmets. All helmets available upon request with Noviweld or Filterweld plates. Helmets dielectric and seamless. No. 944 imitation leather or No. 945 genuine leather sweatband available upon request.

No. 9440 (shown) — Excellent protection for throat, neck and head. Standard aluminum, lightproof glass holder No. 91085 with plastic insert for insulation. No. 94 easy floating headgear with positive lock adjustment.

For complete details on this helmet, other AO Vulcanized Fiber Helmets (No. 9460, 9890 and 9270) and AO Fiber Glass Helmets write for new Brochure S-6311.

AO Sweatbands increase worker comfort and protection, decrease accidents. Check your needs!

American Optical
COMPANY
SAFETY PRODUCTS DIVISION

Always Insist on AO Trademarked Safety Products. Your nearest American Optical Safety Products Representative can supply you.

SOUTHBRIDGE, MASSACHUSETTS
BRANCHES IN PRINCIPAL CITIES

TO REDUCE WELDING COSTS *JETWELD IT!*

Lincoln Jetweld iron-powder electrodes increase welding speeds as much as 50%. Higher welding currents, greater deposition rate, and self-cleaning characteristics make possible drastic reductions in welding labor costs.

Weld appearance is smoother, approaching the bead quality of an automatic weld.

The Lincoln Jetweld family of iron-powder electrodes is available in four different classifications to meet a wide variety of welding requirements.

E-6024 Jetweld 1 for extra-fast welding of flat and horizontal fillet with AC or DC.

E-6027 Jetweld 2 especially well-suited for deep groove butt welds in the flat position.

E-6016 Jetweld LH-70 for all-position welding of all steels and for welding steels of poor weldability.

E-7020 Jetweld 2-HT . . . for high-tensile deep groove butt welds and fillets in flat position.

For complete information on Jetwelding or the Jetweld electrodes, write for Bulletin SB-1351.

THE LINCOLN ELECTRIC COMPANY

Dept. 1733, Cleveland 17, Ohio

The World's Largest Manufacturer of Arc Welding Equipment

When Jetweld electrodes Have higher deposition rates Yet give easiest operating qualities

WHY use anything but Jetweld

SEPTEMBER, 1957

Welding Engineer

ESTABLISHED 1916

Sight-Saving Month

SEPTEMBER has been designated national "Sight-Saving Month" . . . a brief calendar period during which it is hoped that all citizens will give close consideration to one of their most valuable organs.

Virtually everyone in the welding industry knows that, until fairly recent times, many experts in visual problems considered welding operations injurious to a weldor's eyes. With the introduction of adequate goggles, and helmets fitted with good filtered lenses, however, eye hazards were eliminated.

But we still have a long way to go before welding and its related operations will cease to injure eyes. We now have to conquer the human element!

Workers in a welding area, and sidewalk superintendents at a construction site, are common recipients of "flashed eyes." Though not serious, this painful reaction to arc rays could and should be avoided. Bystanders are often unaware of the danger that exists in watching an unshielded arc. But welding crews know the facts of the matter, and should see to it that their work is properly shielded.

Weldors and their helpers still suffer eye injuries, but only occasionally does this occur as a direct result of welding. These thoughtless persons usually get in trouble because they chip slag or grind welds without bothering to wear safety goggles. They seem bent on learning safety the hard way.

SMALL PARTICLES of steel flying from a grinding wheel produce an exciting fireworks display, but one of those minute particles in an eye produces a painful, if not permanently damaging, injury. Such injuries often mean time lost from the job . . . needless time, when the simple act of putting on safety goggles would have prevented the accident.

A blind person develops a remarkable sensitivity to sounds and odors. But who would be willing to trade their sight for these exceptional but sadly limited abilities? All of us are willing to admit that we want to keep our sense of sight, but some of us don't put any more effort into achieving this goal than do the lower forms of life.

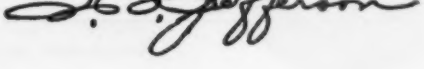
The salamander isn't permanently disabled when he loses a leg; there will soon be another to replace it. But human beings don't possess this built-in capacity for regenerating lost limbs or damaged organs. *Why do some of us behave as though we did?*

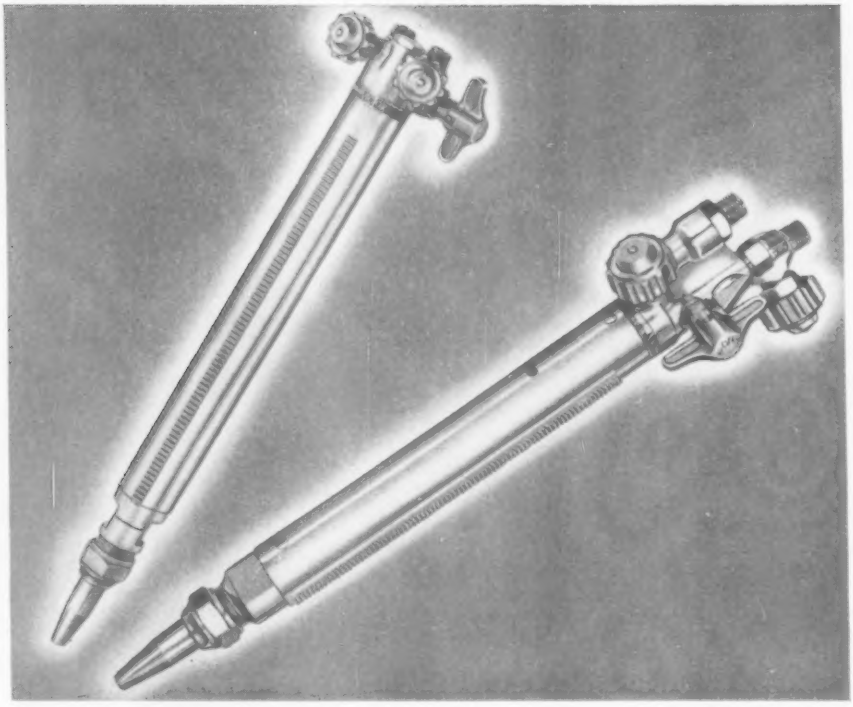
THERE ARE an estimated 334,000 sightless persons in the U. S. today. This figure represents an increase of 27,000 over 1956, and it will continue to grow. We who represent the welding industry can keep many members of "our gang" from joining these disastrous statistics, but it will take the wholehearted cooperation of everyone—from top management on down.

Accidents represent an expense that neither employe nor employer can afford—and one that neither should have to bear. The senseless happenings that rob us of our sight, or of the use of our limbs, *can* be avoided if every job is planned . . . and if we think about every step we intend to take. Planning and forethought will remove the hazardous element from almost all of our activities.

Sure, there are unavoidable accidents . . . mishaps caused by "damfools" who show no regard for their own safety, or that of the persons around them. But, aside from keeping an eye on this dangerous type, *it is our job to see that avoidable accidents never happen.*

Let's not limit our personal sight-saving programs to just one month of the year. Protect your eyes in all your activities all year long.





NEW

VICTOR

MACHINE CUTTING TORCHES

Two Hose Type

MT-200 SERIES for medium pressure acetylene.

MT-200 LPCG SERIES for low or medium pressure fuel gases such as city, natural or petroleum gases.

Three Hose Type

MT-300A SERIES for medium pressure acetylene.

MT-300A LPCG SERIES for low or medium pressure fuel gases such as city, natural or petroleum gases.

Designed for general purpose machine cutting. All commercial fuel gases commonly used for machine cutting can be utilized by selection of the proper size and type of Victor cutting tips and torch model.

These New Victor machine cutting torches feature—

Stainless steel mixing chamber.

Time-tested Victor Spiral Mixer for maximum efficiency and heat resistance.

Convenient control valves for ease of operation.

Popular quick-acting cutting oxygen valve with long life "O" ring packing.

Preheat gas valves with stainless steel ball points and special packing design to hold valve adjustments steady.

For model, type and size best fitted to your needs, call your VICTOR dealer . . . or write us for descriptive bulletins.

VICTOR for welding

VICTOR EQUIPMENT COMPANY

Mfrs. of welding & cutting equipment; hardfacing rods, blasting nozzles; cobalt & tungsten castings; straightline and shape cutting machines.

41

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from *BAD*

"IT cracked in the heat-affected zone, and here's why . . ." says author Holby to Greer student. Tensile test machine was bought at scrap metal prices and rebuilt.

Just as it needs qualified engineers, the welding industry must also have trained weldors — and in far greater numbers. Responsibility for weldor education, never an easy task, has been assumed by many trade schools throughout the country. Among them is Greer Shop Training in Chicago where, for 50 hours or 480, novices and experienced tradesmen learn or expand the welding facts that increase their value to U. S. industry.

Schooldays, nowadays, mean hard work

By Eric Holby
Supervisor of Welding
Greer Shop Training

to *BETTER*

AMBITIOUS young men from all parts of the world have been enrolling at Greer Shop Training in Chicago since 1902. The student roster, at any time, will list home towns representing most of the U. S. and a dozen different countries.

Greer specializes in weldor training, and in teaching the principles of refrigeration, auto mechanics, diesel mechanics, machine shop practice and body and fender repairs. The school presently devotes over 100,000 sq ft of floor space to training classes conducted both at the trade school and at the engineering level.

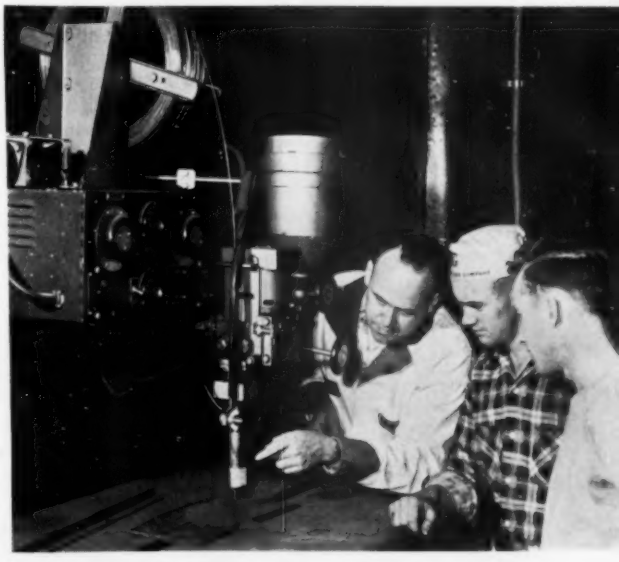
The welding department, one of the most modern of all Greer sections, occupies almost 1/10 of available floor space. Physical facilities of this department include a classroom, a 50-seat movie theater, a tool crib, a steel storage room and the welding shop.

83 Welding Stations

In the shop is a variety of modern equipment distributed among 47 gas welding stations, 32 arc welding stations, and 4 Tig (tungsten inert-gas) welding stations. Six fully-equipped manual flame-cutting stations and a machine flame-cutting station are also available for student use.

Equipment for testing student welds includes a tensile testing machine, several guided bend testers, and machine shop equipment for preparing test coupons.

Although students of all ages may be found in Greer's welding department, the average student is 25 years old. He is obviously eager to learn his trade, for statistics indicate that he holds down a full-time job while attending classes. Upon completion of his course, this



TWO Greer students learn proper method of employing modern automatic submerged-arc welder supplied to the school on loan basis by Hobart Bros. Co.

SOME of the 47 gas welding stations in Greer's welding shop are shown in foreground. Also available for students are 32 arc welding and 4 Tig welding stations. Note complete fume exhaustion set-up.

average student will benefit from the services of a placement department which aids him in finding a profitable job.

Greer's welding department is now in its 43rd year of successful operation. Begun in 1914, this section has graduated over 4,000 students. Industry acceptance of these trainees has now made it possible for the average graduate to find work at wage scales of $2.25 an hour and up.

480-Hour Favorite

The list of welding courses available to new students at Greer is a lengthy one. Very popular are the short, intensive courses in arc and gas welding for future production and maintenance weldors.

But records indicate that the favorite course is one on combination welding.

This 480-hour course includes gas welding of sheet steel in all positions; brazing of steel and cast iron; fusion welding cast iron; welding pipe and aluminum; arc welding steel plate in all positions, and pipe welding.

All classes are in session on a 52-week basis each year. Hours during the day are from 8:00 am until 2:00 pm. An evening division holds its sessions from 6:00 until 11:00 pm, and part-time students meet from 7:00 until 10:00 pm three nights each week.

Classroom work includes the use of such visual aids as slides, motion pictures, charts and models. Blueprint reading, mathematics and welding theory are principle instruction subjects.

Steel Plate Welds

Several 125-hour unit courses are offered by Greer. One deals with the all-position oxyacetylene welding of sheet steel, cast iron, aluminum and pipe. Another teaches the student basic facts on the arc welding of steel plate (in all positions) and of pipe. Instruction in the principles of flame-cutting is a necessary part of every welding course, because of the value of this method in preparing metals for welding.

An advanced course in arc welding makes use of heavier plate, many different joint types, and the use of multiple passes.

Three courses offered by Greer devote only minimum time to classroom theory. Treatment of practical problems is the mainstay of these courses, since they are intended primarily to fill the needs of production and maintenance weldors.

Most advanced of all the arc welding courses is the qualification class which helps students meet requirements of any section of the ASME pressure vessel code (which Greer administers). Included in this course are two bend tests in each of the four positions necessary for qualification under the code.

Special Services

A short 50-hour course in Tig welding is very popular with students already employed as arc or oxyacetylene weldors. Designed to meet the needs of a weldor desiring to up-grade himself, the course offers its students the advantages of the latest in Tig welding equipment.

In addition to its regular welding courses, Greer will set up special sessions for companies that want to have employees trained in some special phase of welding. Many firms have taken advantage of this service, and report that it is more economical and intensive than their own on-the-job training programs.

As an adjunct to its normal function as a training school, Greer has recently undertaken a program of assistance for many small metal fabricating firms in the Chicago area. Companies too small to afford full-time services of an advisory welding engineer can now bring their problems to Greer for expert assistance.

The welding department will handle problems ranging from electrode selection for a specific job to the writing and testing of a procedure specification.

Equipment Supply

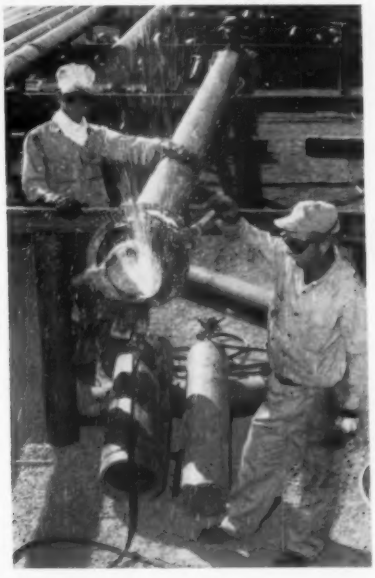
It is an historic—and unfortunate—fact that many welding trade schools have been unable to offer students up-to-date equipment for shop training. Greer, however, has benefited from the generosity of a large manufacturer of welding equipment.

Hobart Bros. Co. of Troy, Ohio, furnished the Greer Shop with many pieces of modern automatic welding equipment on a loan basis. Included in this array of machines is an automatic submerged-arc welder powered by a 600-amp constant-potential d-c generator.

Greer feels that many students on its current roster were attracted by the opportunity of studying the uses of this automatic equipment. The school also believes that it will benefit (as will other weldor training shops) when additional manufacturers of welding equipment loan new equipment for training purposes.

Firms entering into such a loan arrangement will obviously reap their own rewards when graduates purchase the same type of equipment on which they learned their trade.

THE beveling process. Couplings removed, beveling machine is clamped to pipe and flame-cutting torch is cranked around the piece a full 360 deg. Pipes were beveled at a rate of 120 per day; 16,000 were completed in 2 months.



• Welding aids oil industry

Pipe beveling unit aids in reclaiming a 35-year-old line

NEVER in the history of the oil industry has the demand for pipeline construction been as great as it is today. An oil company planning to construct a pipeline next month should have ordered its piping requirements eight months ago.

Unfortunately, not every one is ready to anticipate needs so far in advance. And even if needs can be anticipated, a seven or eight-month wait for delivery can prove costly in terms of lost revenue and customer irritation.

In an expansion job being undertaken by Oklahoma Natural Gas Co., the ingenuity of company engineers not only turned up pipe quickly, but saved the firm money at the same time.

40 Miles of Pipe

Some 35 years ago, Sinclair Oil Co. laid about 40 miles of 8⅝ in. OD line. This installation took place at a time when pipeliners were uncertain about welding. They were evidently leery of screw fittings as well.

Couplings had been screwed to pipe ends, then welded to insure against leaks. The dual joining job apparently was satisfactory, for the line served its purpose well.

In recent years, Sinclair had no further use for this line and left it lying in its right of way. Engineers at Oklahoma Natural Gas knew about the line and felt they could probably solve their critical piping problem by salvaging the abandoned pipe.

Cecil Rainbolt, independent contractor, was given the job of taking up the old Sinclair line and reconditioning it so that 200,000 ft of pipe might once again serve a useful purpose.

Beveling Machine

The salvage work proceeded rapidly, and lengths of pipe were brought into Oklahoma Natural Gas Co.'s yard in Tulsa. At this point, pipe was cleaned and placed on pipe racks made of old railroad rails welded to pieces of casting. The pieces of pipe were now ready for complete rehabilitation.

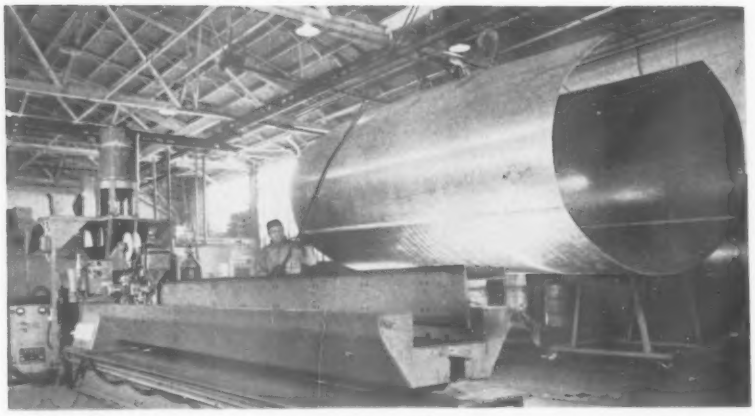
Most important aspect of the rehabilitation program was that of putting new bevel ends on the pipe. This necessitated removal of old couplings, as well as cutting-out of some doubtful weld joints.

The job was quickly accomplished with a pipe beveler produced by H & M Pipe Beveling Machine Co. When the flame-cutting torch attached to the machine was lighted, an operator cranked the torch around the pipe, using a patented horseshoe gear arrangement. Even though 360-deg cutting is done in this type of operation, all bevels were perfect.

The cutting team, which consisted of three men and their pipe beveling machine, cut a total of 16,000 bevels in a two-month period. This is a rate of better than 100 beveled ends per day.

After welds and couplings had been cut out, short beveled lengths of pipe were aligned and welded into random lengths of approximately 40 ft each. This readied the pipe for stringing crews that hauled them back into the field to provide another pipeline for Oklahoma Natural Gas Co.

A current discussion



CV gives constant arc length control in Mig and submerged-arc welding.

The best power source for automatic wire feed?

By L. P. Henderson
Consulting Welding Engineer
Berkeley, Calif.

CONSTANT voltage may not be *the* answer for all phases of welding, but it definitely has great advantages to offer in automatic wire feeders.

Five features of CV control give it these advantages. Relatively simple power and feeder equipment are used. Switching wire feed on gives fast starting.

Normal adjustments in either voltage or current can be effected without materially influencing the other. Current does not drop off, for it is controlled by wire feed rate, which operates independently of welding circuits. Finally, CV is superior to any other power system in gas-shielded arc or high-speed submerged-arc welding.

This article is based on a paper presented at a meeting of AWS during the 10th Western Metal Exposition, Los Angeles, California.

There are three common power characteristics employed in arc welding: constant current, variable voltage-variable current, and constant voltage. Here is a brief analysis of each.

Basic Power Systems

Constant current is distinguished for maintaining an approximately constant current in spite of arc length. This, however, is a disadvantage in automatic wire feeders. An extremely sensitive head would be called for because the only adjustment in arc length is a slightly increased burn-off rate which usually accompanies a short, rather than a long, arc.

Variable voltage is rated excellent with manual stick electrodes. Although, until a few years ago, it was the primary power source for wire feed welding, it is generally being replaced by constant voltage.

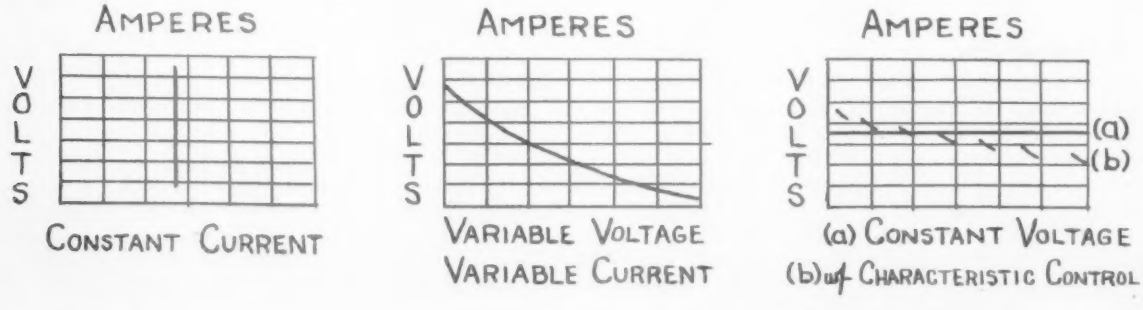
In variable voltage automatic welding, when the arc length is shortened there is an increase of current. Through this, wire feed rate is reduced until arc length is again normal.

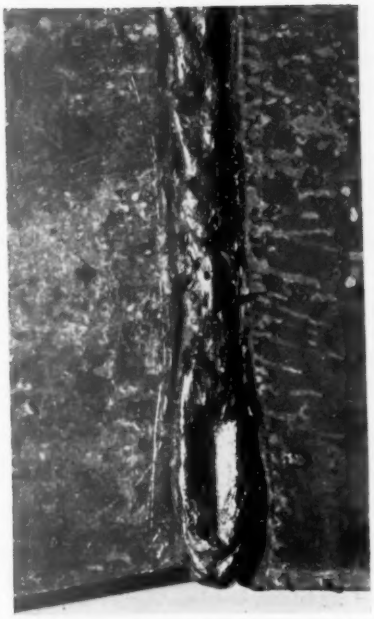
Reversing the situation, when arc length is extended too far, motor speed increases and equalizes arc length. But because a variable voltage head cannot accelerate or decelerate quickly enough to compensate for these speed adaptations, overrun and underrun frequently mar the weld.

Chart Indicates Advantages

The voltage-amperage tables demonstrate how the curve is flattened in *constant voltage*. The wire is now fed at a constant speed and the rate is adjustable. This permits a steady electrode flow and constant arc length. Since voltage does not vary there is no need for variable voltage heads to adjust lengths.

CHART below indicates proper differences between constant current, variable voltage-variable current, and constant voltage.





POOR results of 1 in. double V submerged arc weld with 3/16-in. wire, 1,000 amps at 34 volts, straight CV.

To clarify this, we will compare variable voltage and constant voltage to a scale. When weight is placed on one side of a bell scale, it sinks, causing the other bell to rise. In order to balance the scale again, weight must be equally distributed on both sides.

In a variable voltage scale, arc length is the weight which does the balancing. When the arc lengthens, the scale is trimmed by the head speeding up to regain proper length. If arc length is too short the scale is balanced by the head slowing down until the arc length is once again normal. Thus, the weight (arc length) is constant because the bells (head) are rapidly being adjusted.

In constant voltage, however, the scale is always in perfect balance. Wire feed rate balances one side of the scale and constant voltage flowing through the arc balances the other.

Because arc length is continuously shortened or lengthened by current change, the voltmeter will remain steady, and the ammeter will oscillate rapidly between ±5%. Any variations will be caused by set-up procedures.

High current densities in submerged-arc welding are unnecessary and very often are undesirable. Excessive penetration may result and arcs become unstable particularly when welding with ⅛-in. electrodes, or larger.

Current Densities

A case of this occurred when welding steel plate 1-in. thick, beveled on both sides, with a ¼-in. land. The submerged-arc process was employed, using ⅛-in. wire at 800 amp, 34 volts, and a wire travel speed of 15 in. per minute on a 1200 amp CV welder.

The same current density is found using 800 amp on ⅛-in. wire as with 450 amp on 3/32-in. wire. The amperage on 3/32-in. wire is not excessive, but when used on the larger wire gives poor results: welds are bumpy, uneven, and the ammeter swing is from 500 to 800 amp.

Melting rate (burn-off) of ⅛-in. wire at 800 amp is about 100 ipm. In 1/16th second ¼-in. of wire will be melted. In other words, during the time it takes to snap your fingers, ¼ in. of electrode has entered the arc and been melted.

Moving at a high travel speed, deposited metal is washed out of the crater well behind the electrode. As the speed is decreased, metal builds up closer to the wire until it drops into the crater and momentarily shorts the arc. In CV, this causes an increase of perhaps twice the normal current, lasting sometimes for several cycles.

When welding at 100 ipm at 800 amp, the current jumped to 1600 amp, and at 1/16th of a second, the arc was ¼ in. longer than normal. An abnormally long arc causes current to fall far below regular requirements necessary to correct the situation; travel speed decreases. Metal flows under the electrode once more and the sequence resumes. Uneven weld deposits result.

Wire Testing

To prove that difficulties were caused by wire size, the same amperage, voltage, and travel speed were used, but ¼-in. wire was substituted for the test. Because ¼-in. wire has four times the cross sectional area of ⅛-in. wire, the feed rate is one-quarter slower. Therefore, working with the same 800-amp surge, only 1/16 in. will be melted.

By this means the longer arc was eliminated and smoother welds were deposited. In order to double-check the test, ⅛-in. wire was again used with the same amperage, but voltage characteristics of the welder were dropped from an open circuit 55 volts to 34 volts. Current fluctuations were thus limited to 100 amp, producing acceptable welds.

It can be seen that CV often gives too-rapid arc adjustments under certain conditions, and that high current densities aggravate this tendency. But these drawbacks can be corrected by increasing wire size or changing welder characteristics from flat to moderately drooping, or by using both means.

Another experiment in the use of CV was made while welding 0.025-in. aluminum wire to thin aluminum sheets. Currents were held to less than 50 amp. By changing the characteristics to an open circuit of 9½-10½ volts and a closed circuit of 8-9 volts at 30 amp, good starting and good spray deposits were obtained.

Higher voltage at low current resulted in globular transfer and a rough bead. Also, a characteristic providing more droop at the same 7-9 volt and 30 amp load proved unsatisfactory.

It is hoped that this will lead to the following conclusion: in automatic or semiautomatic welding equipment, a power source designed primarily for CV, but equipped with characteristic control, offers much more than constant current or variable voltage machines.

SAME weld with CV characteristic control allowing a drop from 54 volts open circuit to 34 volts loaded.

MANUAL arc welding of large vessels and tanks is economical if production rate is low and time allotment generous. Automatic equipment will do job faster and more cheaply if production rate is high.

Arc welding defined

The user's problem: matching process to application

By Bela Ronay

THE TERM "welding process" refers both to welding equipment and to the way it is employed in making a weld. (Metal-arc welding, for example, is one process; submerged-arc welding is another.)

The term "procedure" covers every factor concerning the manner in which a welding operation is performed.

For joining metals, any of a number of welding or brazing processes may be used. Each has its value in a particular application. In some fabrications, however, two or more processes may be suitable.

Since this series of articles is primarily intended to aid the practical weldor, it seems best to discuss welding processes in terms of the relationship between their suitability and the nature of the work. Processes will be treated as they relate to these work categories:

(*1*) Pressure vessels and storage tanks;
(*2*) Machinery components;
(*3*) Piping;
(*4*) Structural assemblies.

Selection of a welding process for any of these categories must be based on an examination of certain fundamental factors. These include the *composition* of material to be welded; *gage* of parts; *repetition or limitation* of parts production, and *available equipment*.

There are other factors, of course, but they are not as commonly involved as those listed. Additional factors will be presented as their consideration becomes appropriate.

Vessels and Tanks

Assuming that material discussed under all work categories is *mild steel*, let us consider the first subject heading.

Arc welding processes are the current choice for joining heavy-gage pressure vessels and storage tanks. The arc weld may be applied manually, semiautomatically, or by fully automatic methods.

The difference between these methods, essentially, is found in their rate of weld metal deposition. Semiautomatic arc welding of steel progresses three times faster than that obtained manually. Automatic welding deposits five to 8 times as much weld metal as the manual method.

Manual welding normally requires only certain items of basic equipment: welding machine, cable, electrode holder, electrode and, perhaps, fixtures or positioners. Semi- or fully automatic welding demands more expensive equipment.

Justification for investment in automatic equipment is a matter of arithmetic. Possible wage savings must be considered . . . increased production is an important factor . . . and the rate at which this expensive equipment can be amortized is a vital consideration.

Services and Skills

Various makes and types of automatic welding equipment currently available differ largely in details of construction. The user's choice must be made with regard to skills required to operate and maintain the equipment; dealer's service facilities, and flexibility of apparatus to handle the variety of work on hand and anticipated.

Electrode wire and flux for some automatic machines can be purchased on the open market; for others, only proprietary material can be used. The latter condition should not preclude selection of the equipment if it is best for the work at hand. It does, however, create a potentially dangerous supply situation.

In line with economic considerations in the selection of metal-arc welding equipment for joining heavy-gage pressure vessels and storage tanks, we must also point out that the Mig (metal inert-gas) and Tig (tungsten inert-gas) welding processes are frequently chosen for use with manual arc or submerged-arc processes.

Equipment selected for welding medium-gage vessels and tanks is normally the same as that used on heavy-gage fabrications. And since it is best that downhand welding be used for both types, use of positioners is mandatory.

Naturally, positioners for such heavy fabrications

should be power-driven to attain economical production speed.

A major requirement for consistent production of sound welds with automatic equipment is uniform weld-pass thickness—not less than 1/8 in. and not in excess of 3/16 in., depending on thickness of plates joined and quality of the steel being welded. The heavier deposit thickness is allowable only for better grades of steel.

Hot-rolled, rimmed steels should not be welded with a pass thickness greater than 1/8 in. This warning is especially important for steels that show laminations.

Light-gage pressure vessels and storage tanks are usually articles of mass production, such as domestic water heaters and fuel oil storage tanks.

Because of a highly competitive market, manufacturers employ special equipment that, in many installations, approaches—or has reached—the automation stage. But where lightweight vessels are produced in small quantities only, the applicable process is open for selection—particularly if the material is other than mild steel.

For mild steel, metal-arc welding offers advantages with appropriate electrode types. The Mig method with CO_2 is applicable also. The latter offers high production rates and smooth beads that require little or no finish. But new investment for equipment and the combined cost of welding wire and shielding gas may offset production gains over manual-arc welding, unless there are definite prospects for continuing use of the equipment.

Special Problems

Fabrication of nonferrous vessels presents special problems. Vessels made of copper, copper-base and copper-nickel alloys can be fabricated by manual-arc welding in thicknesses greater than 1/16 in. In gages lighter than 1/16 in., the choice depends on intended use and ultimate environment of the vessel.

For some applications, thin-gage materials may be soldered or brazed. For other uses, seams must be welded. The Tig process is eminently suitable for this work, often without the use of filler metal.

It is often claimed that Tig is applicable for the above materials and gages with a d-c power source. However, experience shows that better control is obtained with transformers equipped with superimposed high-frequency for current stabilization.

On some assemblies, e.g., pressed or cast heads and cylindrical shells, torch brazing is worthwhile only if a few units are produced. Mass production of these assemblies may be carried out economically by furnace brazing if supporting fixtures are not elaborate. When the cost of support fixtures is high and the scale of production warrants it, high-frequency induction heating may be the best method, since it is the fastest.

Assemblies made of materials heavier than 1/16 in. but less than 1/4 in. are best welded by the Tig method if the volume to be produced warrants equipment expenditure.

Copper-Base Alloys

A warning should be given concerning possible deleterious effect of the welding process used on some copper-base alloys. Some of these alloys become susceptible to stress corrosion when Tig welded, and must be postheated to prevent failure.

Fabricators must know if a material is subject to stress corrosion before choosing a welding process. Of course, metal-arc welding is acceptable for fabrication of these alloys in the 1/16 to 1/4-in. range, if its use is economical.

Copper-zinc alloys in the above gages can be welded by the oxyacetylene process if the cost of this process is competitive with that of Mig or Tig. Comparative production data for these materials and processes cannot be presented accurately. Production rates are influenced by factors other than the process alone.

Geometry and length of units is one important factor. Experience with a particular process or material, and subsequent time saved by avoiding special training is another important consideration. For example, the Mig process, because of its speed, permits fabrication of complex geometries and of long cylinders without serious distortion. On the other hand, a small but complex assembly is most readily fabricated by oxyacetylene welding or brazing.

There is no other group of weldments which offers as much opportunity for ingenuity in design as light-gage materials, since for these there is wide variety in the selection of welding processes.

Joint Designs

Joint designs may be chosen to suit available equipment. Often various joints of single units may be fabricated with two or more processes, each applied for a particular advantage: speed, accessibility, or economy.

For heavy and medium-weight machinery components, whether made of steel or of nonferrous metal, the same limitations as given for pressure vessels apply. The only economical process is arc welding, applied either manually or by the use of semi- or fully automatic equipment. Again, use of the latter equipment is entirely a matter of dollars.

The manual arc method is the most flexible, and for complex or virtually inaccessible applications, it remains the only choice.

Choosing the right process for lightweight machinery components is more difficult than the selection for pressure vessels and storage tanks. Materials for small components are selected often for properties which are seldom considered in choosing materials for pressure vessels. Because of this, the welding process must not alter these special properties.

Fabrication of such components often requires special equipment—particularly the various forms of resistance welding. However, there are many lightweight machinery components that can be produced profitably by manual brazing, oxyacetylene welding, by Tig or by manual-arc welding. Since Tig produces smoother beads than metal-arc welding, finishing requires much less labor.

Piping

Pipe welding is a specialty. Pressure piping is usually fabricated in accordance with specification requirements on joint design and the welding process to be used.

The welding process for mild and low-alloy steels is usually metal-arc welding. For thin-wall tubing; especially in smaller sizes, the oxyacetylene process is also used.

Copper-base alloy tubes and pipes are generally torch brazed, using so-called silver solders as filler metal. Torch brazing is widely used, but it is often poorly applied because the proper procedure for it is not fully understood.

To properly employ the torch brazing method, start by cleaning both the bore of the fitting and the tube end to

be placed into it. Make the parts shine with fine emery paper. Wipe both surfaces with a clean rag and apply flux. Use only flux that is free of lumps.

Assemble the joints and heat the tube. Heat until the flux begins to melt. Then—and only then—begin to heat the fitting.

Heating

When the tube is heated first, it expands and comes in contact with the fitting. In this way, when heat is applied to the fitting, it is transferred into the tube also. The whole assembly then reaches desired temperature simultaneously.

This point is indicated when flux becomes glossy. Now is the time to apply filler metal to the end of the fitting or feed hole, keeping flame away from the filler metal. The latter must be molten from the heat of the fitting. When it is, wipe the fitting with the flame, until the heavy fillet

AUTOMATIC welding equipment differs largely in details of construction, author notes, and selection is made on basis of operational ease, equipment versatility and dealer service facilities.

deposited on the face of the end-fed fitting is drawn into the joint, or until metal deposited in the feed hole no longer disappears.

Use the largest torch tip practicable; the most suitable tip gives a wide-spreading, bulbous flame. Adjust flame to a very slight excess of acetylene, using just barely more than required for neutral flame adjustment.

For fittings with pre-placed brazing rings, use the above procedure, heating the fitting until a fine fillet of brazing alloy appears on the face. This indicates that a portion of the joint between ring and outer face is properly brazed. For a perfect job, continue heating the inner half of the fitting after the alloy appears at the face.

Aluminum pipe welding is best done with an inert-gas-shielded arc process. For example, use the Tig process for the first pass in large, thick-wall pipes, then complete the job with the Mig process for greater economy.

Thin-Wall Tubing

Small, thin-wall aluminum tubing should be welded only with the Tig process. Best results and greatest production rates are obtained with a mixture of argon and helium for shielding.

For thin-wall tubes, a mixture of one part helium to six parts argon is the correct proportion. For the first pass on thick-wall tubes, the commercially available 75% helium —25% argon mixture may give best results in penetration, sound weld metal and rate of progression.

Stainless piping specifications often call for use of the Tig process on the first pass. Here again, best results are obtained with an argon and helium mixture in a proportion indicated by wall thickness. These specifications usually prescribe metal-arc welding for the remaining passes in field welding. The use of Mig, however, is permissible in shop fabrication.

Manual-arc welding is used most frequently for the fabrication of heavy and medium weight structural assemblies. Large columns and girders are welded with semiautomatic or fully automatic equipment. Use of the latter is necessary to minimize distortion. While other methods can be used in fabricating steel structures, they are obsolete for metallurgical and economic reasons.

Currently, aluminum structural assemblies are being built for an increasingly widening range of applications. The principal method of fabrication is the Mig process with the Tig process applied for the lighter gages.

Lightweight Work

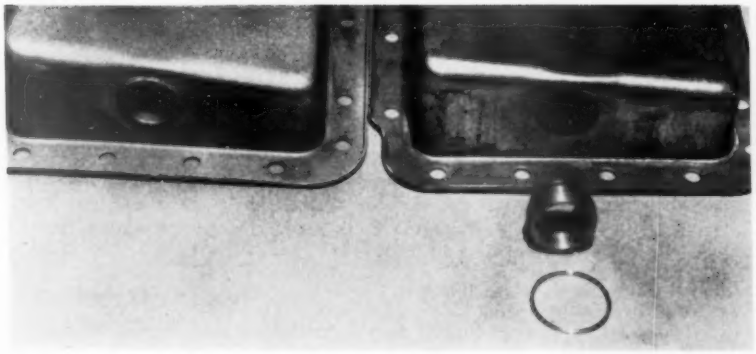
Lightweight, ornamental work is an outstanding example of light weight structural fabrication. Both steel and nonferrous metal are used for this purpose. Methods used are Tig and brazing, depending on the finish required, strength considerations and whether color matching is important.

For steel—if color matching is not required—brazing is the best method as it is fast, makes strong joints and gives a smooth finish which requires little or no touching up. Tig is most suitable. Bronze may be brazed or arc-welded at a lower cost if there are no stringent finish requirements.

Steel and aluminum are popular choices in the fabrication of such light structural assemblies as metal furniture. These metals are often brazed and welded by the oxyacetylene method, others are Tig-welded, and some are torch brazed using silver solder at the joints.

Another light structure is restaurant kitchen equipment. Here, too, Tig and manual arc-welding are used for stainless steel. Oxyacetylene welding is used when the volume of field joints does not warrant expenditure for Tig equipment.

It is evident that choice of the welding process, when there are no specific metallurgical limitations, is a matter of economics. When several types of equipment are available, the choice is not necessarily that which offers the most pounds of weld metal per hour. Suitability of the equipment for the general run of prospective work, market offerings for filler wire and flux, and the sturdiness and simplicity of the control equipment should be given as much consideration as the claims for production rates.



BUSHING and alloy ring used in Dynaflow transmission oil pan. Bushing is fitted from inside oil pan with ring resting on its shoulder. Induction brazing melts ring, forming leak-proof joint.

Automotive manufacturer adds new ideas when Buick uses . . . .

Brazing on Dynaflow

IF YOU drive a Buick with Dynaflow, you can be positive of one thing—silver brazing is making sure the fluid stays in the transmission's oil pan.

At the firm's plant in Flint, Michigan, a method was sought to affix a non-leaking bushing into the pan to receive a drain plug. Plant engineers came to the conclusion that a one-step silver brazing operation would do the job.

The 1½-in. bushing, internally threaded, had to be inset in a hole at the end of the drawn steel oil pan. The joint had to be strong in order to last under the twisting of the plug during factory installation. It also had to be rugged enough to resist any amount of predictable tightening by mechanics at the corner garage.

Standards Met

These qualifications were easily filled since a well-brazed joint between steel parts has a shear strength from 35,000-48,000 psi, according to the steel type used.

Before placing the bushing in the pan, both parts are thoroughly cleaned to remove grease and dirt to insure joint soundness. Each is then coated with a low-temperature brazing flux.

The operator now drops a ring of 3/16-in. round alloy ring (35% silver, 26% copper, 21% zinc, 18% cadmium), manufactured by Handy & Harman, New York, over the bushing. The bushing is then inserted into the hole from inside the pan, the alloy ring riding between the shoulder of the bushing and the inside wall of the pan.

OPERATOR placing pan into brazing machine; output: 240 per hour.

A two station 25-kv heating machine with two induction coils at each station brings the temperature to the 1,295 F necessary to allow alloy rings to flow freely.

Bushing end down, the pans are placed vertically in guide rails. These rails hold the bushing's protruding edge within the diameter of the induction coil. Vertical placement, besides saving space, has the advantage of allowing the bushing to seat itself, via gravity, as the alloy ring melts.

Why Induction?

The advantage of induction heat in this operation is that it concentrates heat at the joint area. Because of this, relatively little temperature rise is noted in the bushing. With the induction coil located on the outside of the pan, capillary action draws the molten alloy all through the joint, producing a fillet around the protruding edge of the bushing.

The twin-station brazing set-up permits the operator to load fixtures in one while bushings are brazed and cooled in the other. By this automatically timed procedure, it is possible for 240 joints to be brazed each hour.

Still-warm flux is removed when the finished part is immersed in a shallow tank containing a mixture of soluble oil and water.

To examine the soundness of the joint, air pressure inspection is used on a pneumatic testing machine. Three pans are placed open side down on a ½-in.-thick rubber pad. This pad covers a platform which moves vertically.

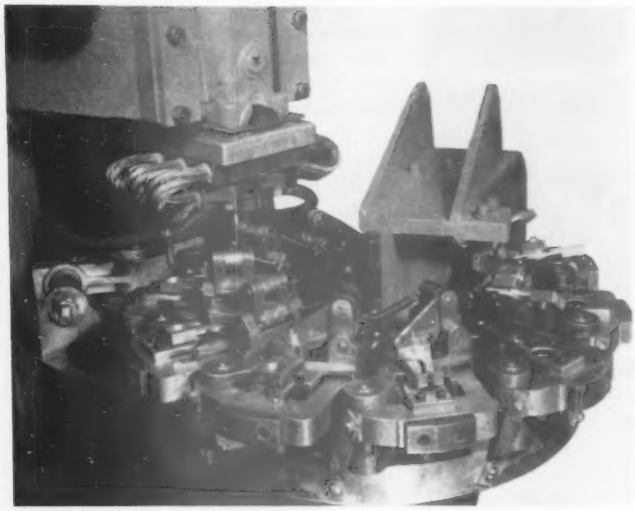
Testing Procedure

Three pneumatically operated, crib-like frames lower onto the flange on the pan's base. This forms an air seal between flange and rubber pad. Rubber sealing discs mounted on the ends of a toggle linkage are forced into the opening of the bushing as soon as the holding fixtures are positioned.

The assembly is then lowered pneumatically into the test tank. Pressurized air enters the interiors of the pans by jets extending up through the rubber pad.

Finally, air bubbling through the water immediately reveals any defective joints.

Brazing flaws are corrected by refluxing the joint and setting another alloy ring with an oxyacetylene torch. The defect rate is quite low, however —usually less than 1%.



THOUGH it has the appearance of a disorderly workbench, this circular fixturing device indexes 10 parts through a welding operation as smoothly as a precision timepiece.

Part fixturing means more and better resistance welds

By Jack Fairlie

AS IN EVERY other phase of welding operations—or of the machining jobs conducted a million or more times daily throughout U. S. industry—jigs and fixtures for resistance welding applications have common, basic purposes.

They also are governed by some universal, as well as by exclusive, rules for construction.

Essentially, jigs and fixtures are employed to:

(1) Position work accurately and quickly, and hold it securely for welding or machining applications;

(2) Enable existing machines to handle work which might otherwise entail special machines or expensive retooling;

(3) Permit the use of unskilled or semi-skilled labor.

RWMA Definitions

According to the Resistance Welder Manufacturers' Ass'n., *jigs* are defined as work-holding and locating devices that are not part of a welding machine. A portable welder can be brought to a stationary jig, or a portable jig (holding a workpiece) can be fed into a resistance welding unit.

Fixtures, as defined by RWMA, are also work-holding and locating devices, but they are an integral part of the welding machine—to which they can be welded, bolted or otherwise fastened.

Virtually all work to be spot, seam, projection or flash-butt welded can be positioned by jigs or fixtures. Naturally, the use of these devices is more common in areas of simply-constructed, high-production items. But jigs and fixtures have great value also in the resistance welding of complex parts under limited production conditions.

Jigs and fixtures are expensive. Even where metal already on hand in a shop can be used, design and fabrication time still bring total costs to a respectable figure. Before embarking on a program of fabricating or purchasing these devices, then, it is to the user's advantage to study his welding operations carefully.

Find the Answers

The user must ask himself, for example, if he is using single spot welding where series spot welds would be quicker and more economical.

He must also discover if seam or projection welding could be used in areas where they have not yet been considered . . . or if flash-butt welding could replace some slower method of butt welding heavy sections.

Only when the user of resistance welding equipment is satisfied that he has matched the right process to the right job can he begin a jig-and-fixture program. And if no one in his shop possesses adequate qualifications to design and fabricate the devices, he is wise to purchase them or to engage the services of an outside counsellor experienced in the particular problems at hand.

For the same reason that copper alloys were chosen for use as electrodes for resistance welding processes, they are

also most popular as materials for jig and fixture fabrication. Copper's toughness (when properly alloyed) and its excellent heat-carrying capacity mark it as ideal for use in close proximity to high-pressure, high-heat operations.

In addition to these advantages, copper is also non-magnetic—as are all materials from which jigs and fixtures for resistance welding must be constructed. Aluminum and aluminum alloys, for example, are popular choices wherever weight savings must be seriously considered.

Cost vs. Strength

The ever-present consideration of cost frequently dictates selection of jig and fixture materials. Non-magnetic cast iron must often be used when limitations of the application do not justify the more expensive aluminum or bronze. But where strength and wear resistance alone are the factors for selection, tungsten-copper, aluminum bronze, or equally tough nonferrous metals will generally be used.

Where copper castings will be employed as parts in a jig or fixture, the user should see that copper or stainless tubing is cast into the part to allow for proper water cooling when the device is in operation.

The throat of a resistance welding machine is that area formed by the upper and lower arms; the electrodes and the machine housing itself complete what may roughly be described as a *loop*. Within this throat exists a magnetic field—a field so intense that it is sometimes capable of melting steel.

Obviously, magnetic materials placed within the throat can create severe difficulties which will impede or halt welding operations. Jigs and fixtures, therefore, can never contain ferrous materials *unless* these materials are well away from the throat of the machine.

The rules for design of resistance welding jigs and fixtures, as mentioned above, are allied to requirements governing similar devices used in other areas of industry . . . and some are also peculiar only to welding.

General Rules

Certain parts of jigs and fixtures must be properly insulated. These parts include all pins, clamps or locating instruments that contact either the workpiece or any current-carrying portion of the work-holding device. Bakelite or some paint-on insulation will successfully prevent these parts from short-circuiting the machine.

Another general rule for jigs and fixtures to be used in conjunction with resistance welding concerns their size. Work-holding devices should be as small as possible within the limits of necessary strength and desired service life.

Third in the list of general rules is one which aids the maintenance of high production rates—*i.e.*, all jigs and fixtures should be designed to permit easiest possible operation and maximum operator protection.

Special Rules

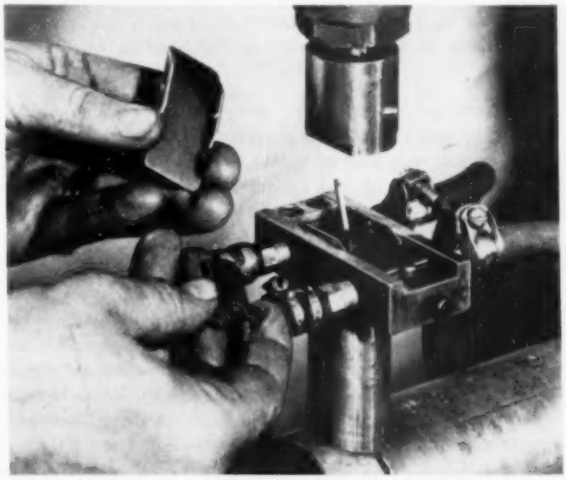
Welding presents an unique problem where jigs and fixtures are concerned in that separate parts placed in a work-holding device are unloaded as a single part. The jig or fixture, then, must be so designed that it will surrender its load with a minimum of dismantling or loosening of clamps.

Those rules for design and fabrication of jigs and fixtures for resistance welding that are peculiar to this particular use of work-holding devices include:

(1) Proper cooling—a necessity for jigs and fixtures in some other applications unrelated to welding, but vitally important when the holding apparatus is subjected to the extremely high heat of resistance welding.

The flood cooling method so popular with seam welding, or the welding of parts under water, are methods that incidentally cool jigs or fixtures holding the parts being welded.

Components of the work-holding device may also be cooled separately through pipes or tubes cast into the copper parts *(as mentioned above)*; by funneling water along troughs cast into sides of the fixture parts, or by forcing water through holes drilled in the parts. Although this latter method obviously does not afford a large surface for cooling, it is still effective.



SMALL fixture is bolted to lower electrode and receives two parts for welding operation. Note hoses carrying cooling water through fixture.

There is one other reliable method of cooling jigs and fixtures, and that is the natural way: allow sufficient time between welding operations for the fixture to air-cool.

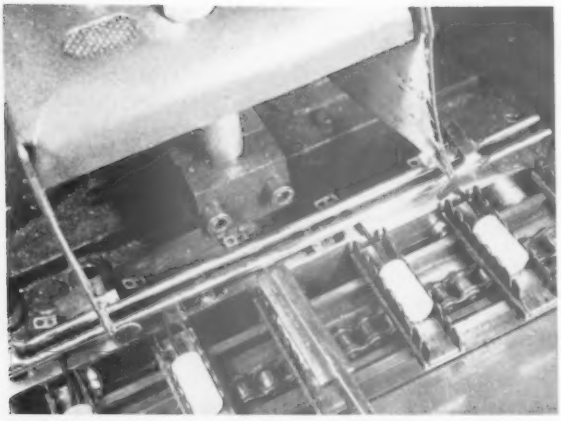
Welding Pressure

(2) Parts being joined by any resistance welding process are subjected to heavy pressure applications by the electrodes. Jigs and fixtures holding these parts must therefore be accurately constructed and strong enough to withstand the forces of deflection exerted upon them.

Even the strongest of jigs, however, will fail to prevent parts distortion or electrode slippage if designers do not eliminate the need for off-set welds wherever possible, and if operators do not check to see that jigs are opposite the fulcrum of the upper arm in a rocker-arm spot or projection welder.

(3) Jigs and fixtures must be designed to allow for electrode wear. As tough as copper alloy electrodes may be, they do suffer wear through continued use. Worn electrodes can be refaced or replaced, of course, but this entails considerable down-time. Greater production economy can be achieved if the operator can simply adjust his work-holding device to compensate for electrode wear.

(4) Some parts of jigs and fixtures holding parts to be



CONDENSERS on assembly-line jigs have small tabs crimped and welded to leads. Hold-down bar clamps condenser in center of picture for welding operation.

resistance welded actually carry current. This occurs whenever one electrode is displaced by the fixture.

To permit easy and adequate current flow in this setup, the jig or fixture should have as few sections as possible in the current-carrying area. Every time the current flow must bridge a joint between parts of a fixture, current reaching the weld area is diminished.

Improve Cross-Section

Another potential hindrance to current can be avoided if current-carrying fixture parts have an adequate cross-section. Members which do not offer a large cross-section naturally set up greater resistance to current flow and create a detrimental voltage drop.

The RWMA notes that rolled copper sections will carry up to 1,800 amp per square inch, and cast copper sections up to 1,500 amp per square inch, at a 50% duty cycle. When such parts are water-cooled, their capacity is increased approximately 100%. However, when duty cycle is increased, less current will pass through the conductor.

(5) Flashing occurs occasionally when spot, seam or projection welding operations are in progress, and regularly during butt-flash welding. Moving parts and sensitive locating devices on jigs and fixtures must be protected from this flash, which can cause a short-circuit or seriously damage parts.

Simplification

The complex of problems arising from the use of jigs and fixtures can be abated to some extent by the selection of a proper resistance welding process, as noted above.

The use of series or multiple spot, seam or projection welding methods should receive more than passing consideration. Advantages to be gained in making two or more welds with one stroke of a welding arm can far outweigh the cost of new machine purchases or old machine changeovers when parts must be fixtured.

Other methods for simplifying the tedious and time-consuming job of clamping parts into fixtures and removing them after welding are readily available. Some of the necessary equipment can be expensive but, again, increasing production which will result should justify this investment.

Magnets or spring-loaded clips can be affixed to an electrode to provide the easiest and least expensive form of accurate parts location where parts are very small and hard to position. Solenoid-operated valves can be employed to actuate clamping cylinders. A number of identical fixtures can be mounted on a circular base to move continuously under the electrodes and permit easy loading and unloading.

Fixtures can be collapsible, or they can be mounted on wheels. Automatic locators can be added to the fixture, as can loading guides and other simple but immensely helpful devices. And all can be added at a cost that may readily be justified by a highly important or high-production application.

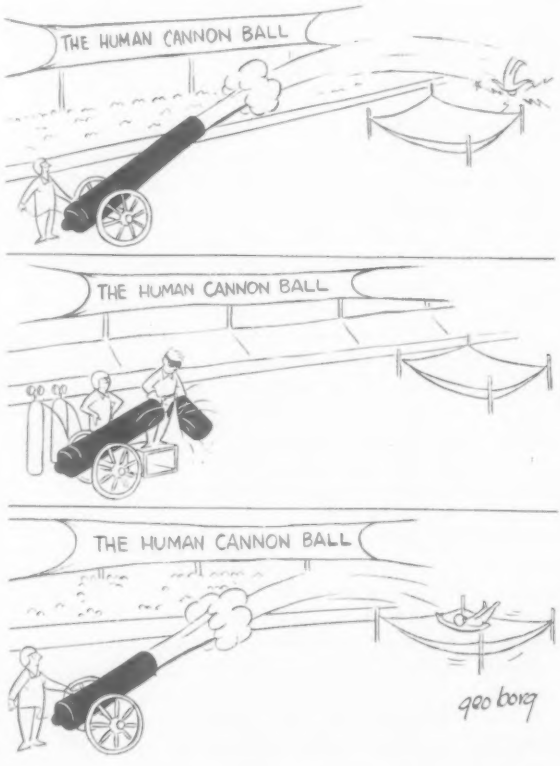
Invaluable Aids

In some industries, as much time is spent on jig and fixture design and construction as is spent on equipment selection, installation and programming of resistance welding operations. This time is not wasted: witness the astronomical production schedules being maintained by the automotive, aircraft and appliance industries.

In these fields, fixturing developments have established invaluable guides for other areas of U. S. industry.

And as the importance of good welding design is more fully acknowledged, the art of good fixturing can only attract more and better practitioners. In operation today are resistance welding machines that require little more of the operator than vigilance and the manipulation of switches or buttons to start and stop automatic sequences.

These automated marvels might have remained unrealized dreams if it were not for equally impressive fixturing installations that require no human assistance whatsoever.



Soldering aluminum: a report

By J. D. Dowd
Alcoa Research Laboratories
Aluminum Company of America

INTRODUCTION

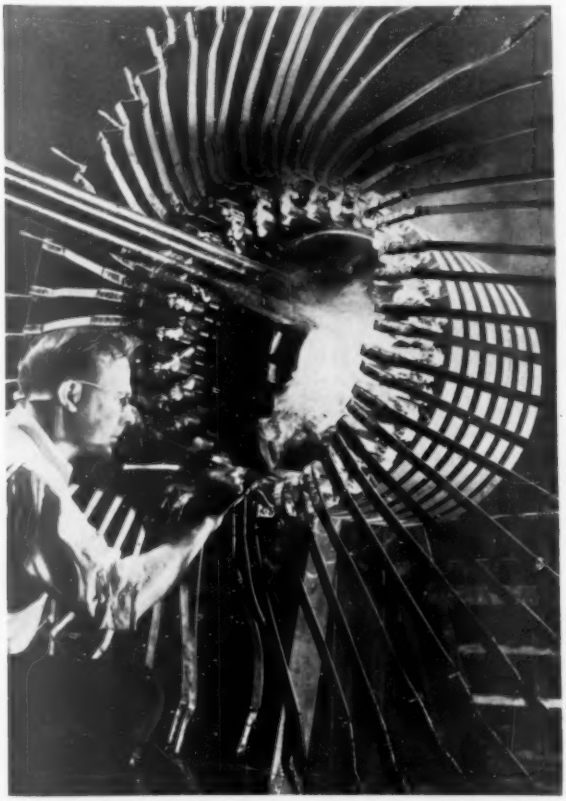
Soldering aluminum differs from soldering copper, brass, steel and most other common metals in several ways. Perhaps the most important difference arises from the formation of tenacious and refractory oxide, which demands the use of more active fluxes than those normally employed.

A second difference is that solder does not flow into certain types of aluminum joints as well as it does on other metals.

A third important difference is that the resistance to corrosion of soldered aluminum joints is more dependent upon colder composition than it is for similar joints on copper, brass or steel.

Because of these and other differences, soldering of aluminum is not as well understood or as extensively used as is soldering of other common metals.

ALUMINUM SOLDERS can be conveniently termed low-temperature, intermediate-temperature and high-temperature types. Low-temperature solders, which melt and flow below about 500 F, may be defined as solders composed primarily of low-melting metals such as tin, zinc, lead, cadmium and bismuth. They may also contain small amounts of such high-melting metals as aluminum, copper, nickel and silver.



ALUMINUM can be soldered with conventional soldering irons or guns. Low-temperature solder and organic flux is used.

Intermediate-temperature solders, which melt and flow between 500 and 720 F, are similar in composition to the low-temperature types except that they contain appreciably more zinc.

High-temperature solders, which melt between about 720 and 800 F, may be defined as those having zinc as the major constituent along with small amounts of such high-melting metals as aluminum, copper, nickel and silver. The properties of the more common solders for aluminum are compiled in WELDING ENGINEER's Data Sheet No. 204, which accompanies this article.

Low-temperature solders are generally tin-zinc alloys, in which tin represents the larger amount. The best low-temperature solder is the tin-zinc eutectic containing 91% tin-9% zinc. This solder melts at about 400 F, wets aluminum readily, flows easily, and of all low-temperature solders, has the highest resistance to corrosion on aluminum.

Lead Substitutes

Because of its high tin content, however, the 91-9 alloy is expensive. To reduce the cost of this and other high-tin solders, lead is frequently substituted for some of the tin. Unfortunately, lead decreases solder wetting and flow, and also reduces corrosion resistance of the resultant joints.

In fact, the ordinary lead-tin solders used for soldering copper, brass and steel are among the poorest for soldering aluminum. The addition of even a few percent of zinc or cadmium to such solders improves both their soldering characteristics and their resistance to corrosion.

In general, assemblies made with low-temperature solders have poor corrosion resistance and should not be used in corrosive environments unless some protection is applied to the soldered joints.

Intermediate-temperature solders are usually either zinc-tin or zinc-cadmium alloys containing about 30 to 90% zinc. They may also contain such metals as lead, bismuth, silver, nickel, copper and aluminum. Among the more common of these solders are the 70 Sn-30 Zn, 70

The paper on which this article is based was part of a symposium on solder presented at the annual meeting of the American Society for Testing Materials. It is printed with the permission of the Society.

Zn-30 Sn, and 60 Zn-40 Cd solders.

Because of their higher zinc content, these intermediate-temperature solders generally wet aluminum more readily, form larger fillets, and give stronger and more corrosion-resistant joints than low-temperature solders.

Solder Alloys

High-temperature solders contain from 90 to 100% zinc along with small amounts of high-melting metals such as silver, aluminum, copper and nickel. These additions are made to lower the soldering temperature, to obtain a wider melting range and to improve wetting qualities.

This last reason may seem strange since it is known that zinc alloys with, and dissolves, aluminum quite readily. However, pure zinc tends to ball up before it wets aluminum, so it is not as satisfactory a solder as those containing small additions of high-melting metals.

Because of their high zinc content, high-temperature solders are the strongest and cheapest of all solders for aluminum. They also have the best corrosion-resistance characteristics, being markedly superior to low-temperature and intermediate-temperature solders.

To assure highest resistance to corrosion, the high-temperature solders should be free from lead, tin, cadmium, bismuth, and other low-melting metals. This necessitates the use of 99.99% zinc in their preparation.

All solders for aluminum can be prepared in either cast or wrought forms. Wrought forms of the low- and intermediate-temperature solders should not contain aluminum, however, since it causes rapid embrittlement of these solders.

Penetration

Heat-treatable aluminum alloys in the aged condition, and the non-heat-treatable alloys containing more than about 1½% magnesium in the cold-worked condition, are extremely susceptible to intergranular penetration when soldered under stress at temperatures less than 700 F. This penetration is very rapid and will crack sheets almost instantaneously.

It can be prevented by stress relieving prior to soldering; however, any stress-relief treatment involving heating will affect properties of the sheet and therefore may not be feasible.

It can also be prevented by using an Alclad product since the cladding serves as a barrier between solder and alloy. Where it is not possible or feasible to use an Alclad product, an electroplating, such as copper, can be used as a barrier to prevent this penetration.

Aluminum, like other metals, can be soldered only if contaminants and oxides on the surface are first removed. This is generally done with fluxes.

For soldering aluminum, there are two general flux types: the relatively new chloride-free organic fluxes and the much older chloride-containing reaction fluxes. Both flux types are also satisfactory for soldering most other metals. A number of properties of these fluxes are also listed in the Data Sheet.

Organic Fluxes

Organic fluxes, which are amber- to brown-colored liquids of syrupy consistency, are active in the approximate range 350 to 525 F. Above 525 F, these organic fluxes carbonize and char, leaving a residue that acts as a stop-off to prevent soldering.

For this reason, they should not be used in direct contact with soldering irons or torch flames. During soldering, these organic fluxes react with the oxide and remove it from the aluminum. At the same time, copious fumes are released and must be exhausted.

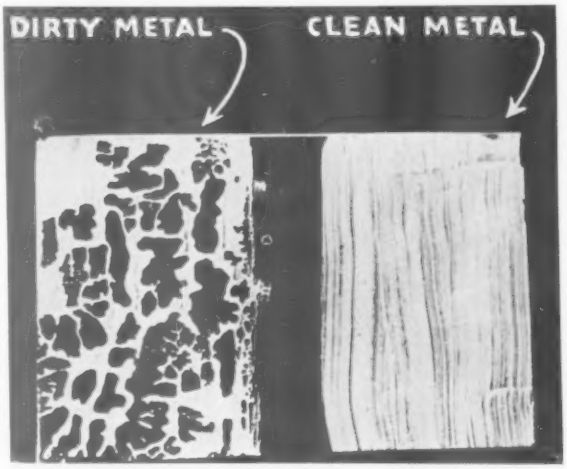
Also during this reaction, gas bubbles form in the flux. Because of this formation, it is almost impossible to make porosity-free lap joints using these fluxes. This often limits their use to soldering line-contact and similar joints where flux can be easily displaced by solder.

Since organic fluxes are electrically conductive, they should be used for electrical applications only with discretion. These fluxes are relatively expensive. They can, however, be diluted to about 50% with alcohol or water.

Chloride-containing salt fluxes are generally based on heavy-metal chlorides that react with aluminum at a definite temperature to deposit the corresponding heavy metal on the surface and thus assist solder flow. This reaction is accompanied by the formation of aluminum-chloride fumes which must be exhausted.

Powder Fluxes

These fluxes are generally used either as a dry powder, as a solution in water, or as an organic solvent. Some of these fluxes cannot be used as water solutions or suspensions because heavy-metal chlorides in them react with the water to form oxy-chlorides which act as stop-offs to prevent soldering.



EFFECTS of clean and dirty metal upon flux distribution is clearly seen here. Solder applied to poorly fluxed area would fail to penetrate aluminum oxide in at least 50% of this area.

Residues from the fluxes are corrosive to aluminum and should be completely removed to prevent corrosion subsequent to soldering. Most of the salt fluxes and their residues are hydroscopic and electrically conductive. Consequently, they should be used for electrical applications only with discretion.

The cost of chloride-type salt fluxes varies from inexpensive to expensive, depending upon cost of the heavy-metal chloride used.

Effectiveness of chloride fluxes is reduced appreciably, and that of organic fluxes to a lesser extent, by silicon in aluminum alloys. The efficiency of organic fluxes is also

Characteristics of several solders for aluminum

Composition	Type	Melting Range F	Density* Lb/Cu In	Relative Cost**	Wetting of Al	Fluxes	Corrosion Rating
50 Sn-50 Pb	Low temp.	360-423	.32	100	Poor	Org. & Salt	Poor
34 Sn-63 Pb-3 Zn	Low temp.	338-492	.34	76	Poor	Org. & Salt	Poor
91 Sn-9 Zn	Low temp.	398	.26	156	Fair	Org. & Salt	Fair
70 Sn-30 Zn	Inter. temp.	390-592	.26	127	Good	Salt	Fair
40 Cd-60 Zn	Inter. temp.	509-635	.28	142	Excellent	Salt	Good
30 Sn-70 Zn	Inter. temp.	390-708	.26	71	Excellent	Salt	Good
10 Cd-90 Zn	Inter. temp.	509-750	.26	56	Excellent	Salt	Good
5 Al-95 Zn	High temp.	720	.24	29	Excellent	Salt	Excellent
100 Zn	High temp.	787	.26	29	Good	Salt	Excellent

*Calculated Density

**Cost of metals alone. 50 Pb-50 Sn = 100

Characteristics of soldering fluxes for aluminum

Characteristic	Chloride-free Organic Fluxes	Chloride-containing Salt Fluxes
Form	Viscous liquid	Dry powder
Flux solvents	Alcohols, water	Alcohols, water
Fluxing range, F	350-500	600 up
Fume generation	Copious	Copious
Heavy-metal deposition	Slight	Slight to heavy
Corrosiveness of flux	Very slight	Severe
Corrosiveness of residues	None	Severe
Elect. conductivity of flux	Moderate	High
Elect. conductivity of residues	None	High
Relative cost	Expensive	Inexpensive to expensive
Handling precautions	Avoid exposure on skin, exhaust fumes	Avoid exposure on skin, exhaust fumes

INDUCTION method for soldering is difficult to apply because of problems in designing coils to give uniform temperature throughout assembly. Where proper coils are designed, however, this method is fast and convenient.

reduced considerably by magnesium in the alloys. In fact, aluminum alloys containing more than about 1% magnesium cannot be satisfactorily soldered using organic fluxes. Such alloys can, however, be easily soldered using the chloride type.

Films that form on aluminum during heat treatment reduce effectiveness of both organic and chloride fluxes. This is especially true for alloys containing magnesium. These heat-treating films can be removed with solutions of sodium hydroxide or hydrofluoric acid.

Dissimilar Metals

Aluminum alloys can, of course, be soldered to dissimilar metals as well as to one another. In making such dissimilar metal joints, soldering fluxes suitable for aluminum must be used to obtain satisfactory wetting.

Aluminum can be soldered by most of the common methods, such as torch, iron, dip, furnace, and induction soldering. It can also be soldered by several methods which are more applicable to aluminum than to other metals. These include rub, ultrasonic, and reaction-flux soldering.

For some applications, it may be desirable to preplate aluminum with copper, nickel or some other metal, and then use procedures applicable to the plating metal. The specific soldering method to be employed for a given application will depend upon the shape of parts being soldered, joint design, performance requirements of the soldered assembly, and over-all economics of the various methods.

Torch soldering, either manual or automatic, can be done on aluminum using any type of gas-air or gas-oxygen flame. To avoid melting aluminum, a cool flame should be used and should not be concentrated at any point too long, especially when thin metal is being soldered.

The flame should be played on the aluminum away from the joint area, allowing the joint to be heated by conduction. This is especially important if an organic flux is used since the flux will burn and char in the flame, leaving a residue that acts as a stop-off to prevent soldering.

Flame Dangers

Direct impingement of flame on salt fluxes should also be avoided since the heavy-metal chlorides may react with water produced in the flame to form oxy-chlorides, also acting as a stop-off.

After soldering with chloride fluxes, it is necessary to remove all flux residues because they accelerate corrosion. If thin-gage wire or foil is used, it is also desirable to remove the residues from organic fluxes. This precaution is not necessary when heavy-gage aluminum is soldered using organic fluxes.

Aluminum can be soldered with conventional soldering irons or with the newer soldering guns. Such soldering is usually a manual operation, using low-temperature solders and organic fluxes.

The technique employed in soldering aluminum with an iron is essentially the same as that employed in soldering copper, brass or steel. Care should be taken, however, to minimize contact of the iron with organic flux. Even though such care is taken, some char will form on the iron and must be occasionally wiped off.

Dip soldering is a convenient way to join aluminum with any of the different solder types. In dip soldering, parts are first fluxed and then dipped into the molten solder.

Solder Baths

If the mass of a part is large, it may be desirable to preheat it in a solder bath or by some other means prior to fluxing. When preheating is employed, it is not possible to use water or alcohol solutions of the salt-type fluxes; instead, molten baths of these fluxes must be used. However, preheated parts *can* be dipped in organic fluxes.

As is the case when soldering aluminum by other methods, it is *necessary* to remove flux residues when salt-type fluxes are used, and *desirable* when organic fluxes are used on thin-gage metal.

Aluminum assemblies can be readily furnace soldered in an air atmosphere. This type of soldering is especially suitable for joining such intricate assemblies as automobile radiators.

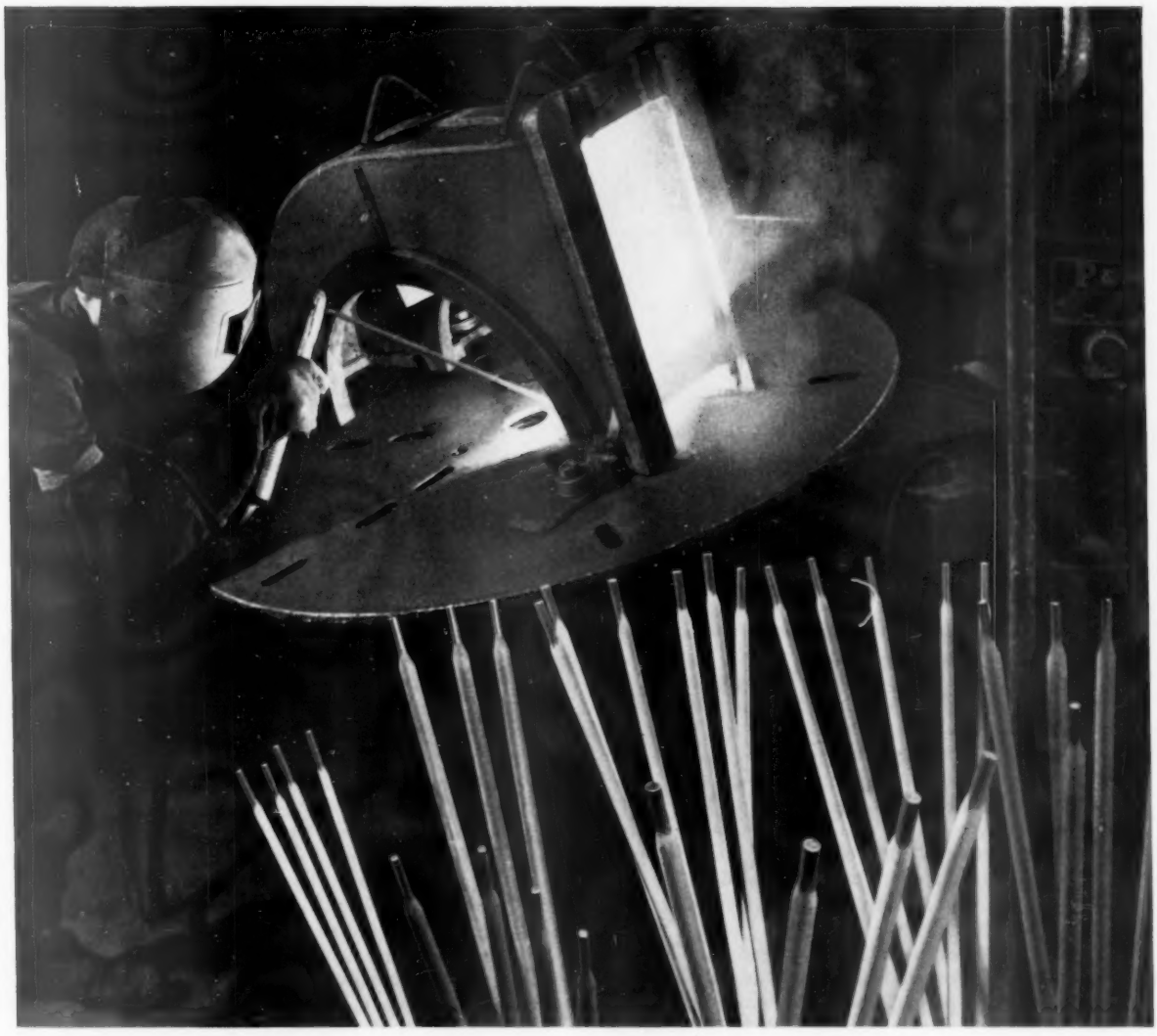
Parts are first jigged with solder in position, either as preplaced filler alloy or as a coating on the components. The assembly is then fluxed, using either an organic or a salt flux, and processed through the furnace. After soldering, flux residues are removed in the same manner as for other soldering methods.

The induction method offers a rapid way to solder aluminum automatically. It is similar in some respects to torch soldering and, in other respects, to furnace soldering.

Induction Difficulties

Because of the difficulty in designing induction coils to give uniform temperature throughout an assembly, this method is not easily adapted to soldering intricate assemblies. For applications where proper coils can be readily designed, however, induction soldering is a convenient way to join aluminum with high- or low-temperature solders.

Wipe soldering is used to join aluminum cable sheathing



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to lead or aluminum sleeves where the cable is spliced. In making such joints, parts are first heated by pouring molten solder over them, after which the joint is fluxed. Additional solder is spread over the area to tin the surfaces.

The joint is completed by wiping solder in the same manner used on other metals. In wipe soldering aluminum, low-temperature solders with proper freezing-range characteristics are generally used in conjunction with organic fluxes.

Aluminum is unique among the common metals in that it can be readily tinned by mechanically abrading surfaces covered with molten solder. Once the oxide has been broken, solder wets the aluminum readily.

This method is commonly called rub soldering. It would be more correct, however, to call it rub tinning, since a subsequent soldering operation is generally required to join rub-tinned surfaces.

Solder Composition

Ease of rub tinning depends upon solder composition. Zinc-cadmium solders are the best in this respect, with zinc-tin solders high in zinc being almost as good. Lead additions make tinning more difficult, and common, binary lead-tin solders have very poor rub-tinning characteristics.

When rub tinning aluminum, care must be taken to insure complete tinning, since solder tends to smear over, or bridge, unsoldered areas without wetting the surface.

In the last few years, ultrasonic soldering of aluminum has been given wide publicity. Many claims—some of them extravagant—have been made for this method.

In ultrasonic soldering, cavitation produced in the solder pool between the tip of an ultrasonic iron and the aluminum surface breaks up oxide and permits solder to wet the aluminum. This wetting is confined to the area under the tip and occurs only when a molten solder pool exists between tip and metal.

Ultrasonic soldering is therefore essentially a tinning operation, and subsequent soldering is usually required to join the tinned parts. As in rub tinning, care must be taken to prevent molten solder from bridging unwetted areas and giving the appearance of a completely tinned surface.

Ultrasonic Tinning

Ultrasonic tinning is affected by solder composition in the same manner as rub tinning. Thus, the best solders for ultrasonic tinning are zinc-cadmium and zinc-tin solders having high zinc contents.

In ultrasonic soldering, it is very often necessary to design and build special soldering tips and transducer assemblies for specific applications. For this reason—along with the fact that ultrasonic equipment is complex and costly, and because separate tinning and soldering operations are usually required—use of the ultrasonic method appears to be limited to applications that are impossible or inconvenient for use of flux-soldering procedures.

Ultrasonic tinning does, however, show great promise as a production-line method for solder-coating aluminum wire, strip or components.

Reaction-flux soldering, or reaction soldering as it is often called, is one of the oldest methods of soldering aluminum.

Such soldering depends upon the deposition of sufficient heavy metal from reaction-type fluxes to produce soldered joints. This is an effective way for making line-contact joints between aluminum and aluminum, or between aluminum and other metals, such as copper and steel.

USING preplaced solder, aluminum can be joined by the furnace method with an air atmosphere. Either organic or salt flux is used, and flux residues must be removed immediately after soldering.

Salt Flux

In reaction-flux soldering, salt flux is mixed as a suspension, usually in an organic solvent such as propyl alcohol. This suspension is applied to the assembly by some convenient means, *i.e.*, by pouring or spraying it on, or by immersing the assembly in the suspension.

The assembly is then heated until flux reacts to deposit the heavy metal, which flows to make the joints. Exhaust equipment must be available to remove the aluminum chloride fumes generated.

With this type of soldering, all surfaces originally covered with flux have a layer of the corresponding heavy metal deposited upon them. It is essential to remove all flux residues from assemblies, since these residues are corrosive to aluminum.

Necessity for removing flux residues depends upon the type of flux employed. When organic fluxes are used, it is generally not necessary to remove residues except when thin-gage aluminum is being soldered. Such flux removal can readily be done with water or alcohol. Any flux residues not soluble in water or alcohol should not accelerate corrosion.

It is essential that all residues from chloride fluxes be removed since they will accelerate corrosion. The major portion of such residues can be removed in boiling water.

Rinses

To insure more complete removal, the soldered assembly can be immersed in an inhibited alkaline solution, followed by a water rinse, a weak acid neutralizing rinse, a final water rinse and a forced-air dry. In general, a cold, inhibited 5% solution of sodium hydroxide is satisfactory for cleaning, and a cold 2% solution of phosphoric acid is employed for neutralizing any residual caustic.

In some applications—for example, stranded cable—it may not be possible to remove flux residues effectively even though cleaning solutions are used. In such cases,

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flux residues will probably accelerate corrosion.

The use of soldering as a method for joining aluminum depends largely upon required performance of resultant joints. Of all performance characteristics, corrosion resistance is by far the most important; although in some cases, joint strength and interface embrittlement between solder and base metals may be important.

Strength of soldered joints in aluminum is essentially the same as that of soldered joints in other metals, and depends upon joint design and solder composition. In general, strongest joints are obtained with high-temperature solders, and weakest joints with low-temperature types.

Formation of brittle interfaces between aluminum and solders is not a problem. When aluminum is soldered to copper, brass and many other metals, however, a brittle interface does form between solder and base metal if zinc- or cadmium-containing solders are used. Since this interfacial layer formation is more rapid at elevated temperatures, the effect becomes progressively worse as operating temperature of the soldered assembly is increased.

Corrosion Resistance

Corrosion resistance of soldered joints in aluminum is affected by a number of variables.

It has already been pointed out that solder composition is important. Pure zinc, or zinc containing small amounts of aluminum, copper, nickel or other high-melting metals, is the best solder, corrosion-wise, for use on aluminum.

Addition of low-melting metals to such solders decreases the corrosion resistance. In this respect, lead and bismuth are much worse than tin and cadmium.

Flux composition can also have an effect. When reaction fluxes are used, it is preferable to use one depositing zinc instead of tin, cadmium, lead or other low-melting heavy metals. Flux residues from these heavy-metal salt fluxes are corrosive unless they are completely removed after soldering.

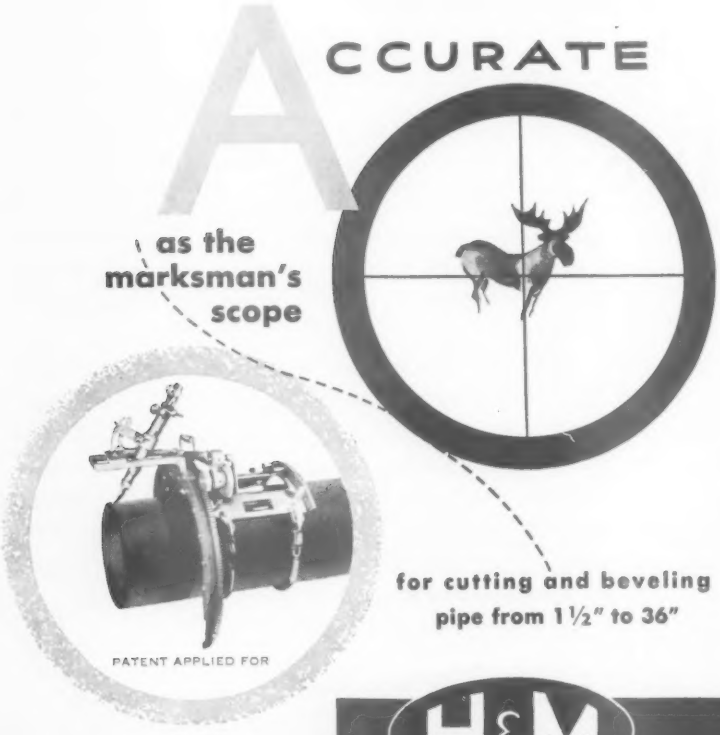
Plating aluminum with copper, nickel, silver or other high-melting metals prior to soldering generally improves corrosion resistance, especially if plating not covered by solder is removed after soldering.

Joint Design

Joint design also has a great effect on corrosion characteristics. The best joints are those not readily penetrated and pried apart by corrosion products. Cable-to-lug joints are therefore much better, corrosion-wise, than lap joints. In general, for all joint designs, *time before failure increases with increasing length of corrosion path.*

Perhaps the greatest single factor affecting corrosion resistance of soldered joints is the environment in which they are exposed. In dry environments, even soft soldered joints last almost indefinitely; in humid or marine environments, however, such joints fail in a very short time.

If soldered joints are to be exposed to corrosive environments, their life can be greatly increased by using protective coatings. But to obtain this increased life, coatings must be continuous and must have inherently good corrosion resistance in the given environment.



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When you specify TUBE-TURN* products, you are sure of getting the exact fittings for your job because the Tube Turns' line is the world's most complete . . . *you save engineering time.* Your welders can work faster because fittings are completely identified and perfectly uniform . . . *you save construction time.* You can buy all your fittings with one order from your nearby Tube Turns' Distributor . . . *you save purchasing time.* Are *you* getting these savings in piping costs?

*"TUBE-TURN" and "tt" Reg. U. S. Pat. Off.

Installation of aluminum piping for handling ammonium nitrate.

The Leading Manufacturer of Welding Fittings and Flanges

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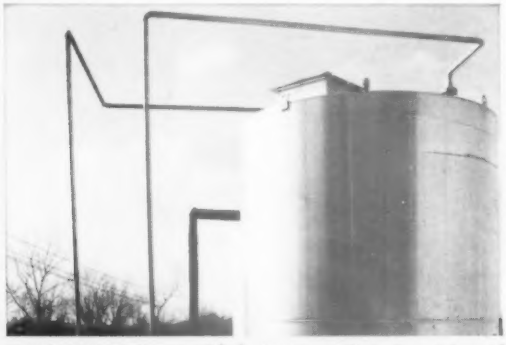
OTHER APPLICATIONS SHOWN ON REVERSE SIDE ▶

In Aluminum piping too...

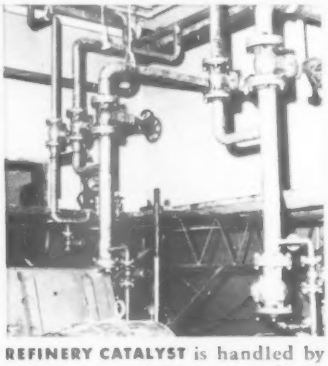
You save manhours with the line of 12,000 TUBE-TURN® products

LIQUID SUGAR. Part of welded aluminum piping system for processing of liquid sugar. When you specify TUBE-TURN* products, you can count on getting the right type, size, schedule and material for every piping service. Saves engineering manhours.

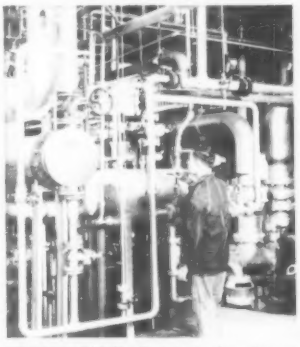
"A-POWER." These TUBE-TURN Aluminum Elbows are for nuclear swimming pool reactor water-coolant lines. Tube Turns' experienced engineering service helps you solve piping problems of all kinds. Contact your nearby Tube Turns' Distributor or District Office.



OLEIC ACID. These welded aluminum lines for oleic acid storage show how this strong but lightweight construction can be utilized for corrosive service. Your nearby Tube Turns' Distributor can give you complete-line service promptly . . . to help you save purchasing time.



REFINERY CATALYST is handled by this aluminum piping, equipped with TUBE-TURN welding fittings and flanges. Uniformity of TUBE-TURN products saves construction manhours



PURE WATER. Passive aluminum piping guards against contamination in this water purification plant. You can buy *all* your fittings with *one* order when you specify TUBE-TURN products.

NEW BOOKLET—This new Tube Turns' catalog gives helpful information on aluminum pipe, fitting and flange materials. Mail the coupon for your free copy.

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Please send free copy of new catalog on Aluminum Fittings and Flanges.

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*Company Address*_____

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*Position*_____

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DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Chicago • Detroit • Atlanta • New Orleans • Houston • Midland • Dallas • Tulsa • Kansas City • Denver • Los Angeles • San Francisco • Seattle. **IN CANADA:** Tube Turns of Canada Ltd., Ridgetown, Ontario • Toronto, Ontario • Edmonton, Alberta • Montreal, Quebec.

PIT positioner in action. Removable floor plates allow workpiece to be lowered for convenient handling by weldor. When the weldment can be done on floor of the building, the plates are replaced. This puts the positioner table three ft above the floor. A steel fabricator installed setup because of overhead-space shortage.

Pit positioner provides novel solution for space problems

IT HAS long been known that positioned welds made downhand are best; both from a quality and a cost standpoint."*

With this fact in mind, a large Eastern steel fabricator decided to install a positioner even though the firm's operating space offered very little headroom. The solution was reached by utilizing a specially designed pit into which the positioner was set.

Removable Plates

Setting the positioner in the pit enables the company to weld large workpieces within its limited space. Since the Harnischfeger positioner chosen by the plant has a tilting range of 135 deg and 360-deg rotation, weldors are always able to weld downhand with a minimum of time and effort.

Floorplates around the positioner allow the workman close approach to the unit when welding is done on a horizontal plane. When the positioner table must be tilted into the pit, however, plates are removed. The weldor can now descend and, as the table is revolved, make downhand welds on previously out-of-reach areas.

Lowers Time

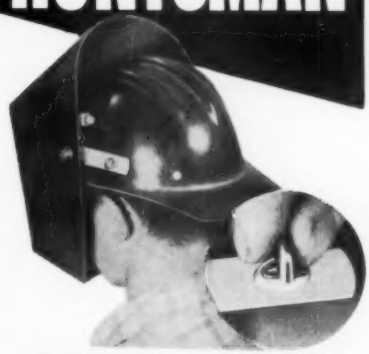
Before the pit idea was hit upon, large weldments were placed on the floor and positioned by manpower and an overhead crane. This expensive — often dangerous — procedure had to be repeated as many as ten times before welding was completed.

Weldments now are handled only twice. Because the workpiece is positioned automatically, it need only be placed on the table and unloaded. Thus a 33 to 50% time reduction is realized, and maximum safety becomes the rule.

Because all welds are made downhand, large diameter electrodes may be used. From this the company gains greater deposition for its electrode dollar and far better weld quality.

Welding Encyclopedia, "Positioners," p. 524, 13th edition

GET FULL HEAD PROTECTION
100% of the time
HUNTSMAN



New Combination Hard-Cap Welding Helmet
NOW with new
ROTO-CLIP
permits you to detach or attach helmet without removing Hard-Cap from your head. ORDER TODAY!
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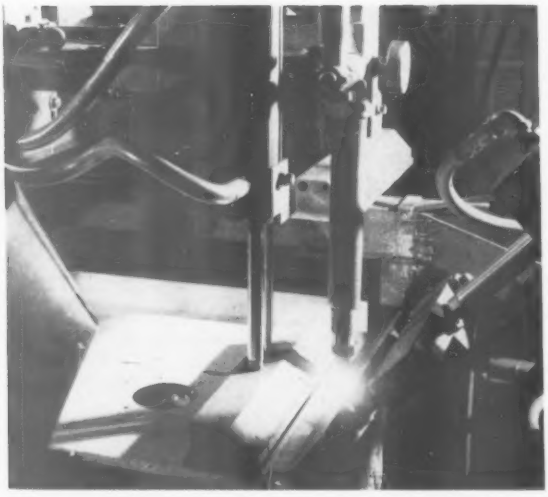
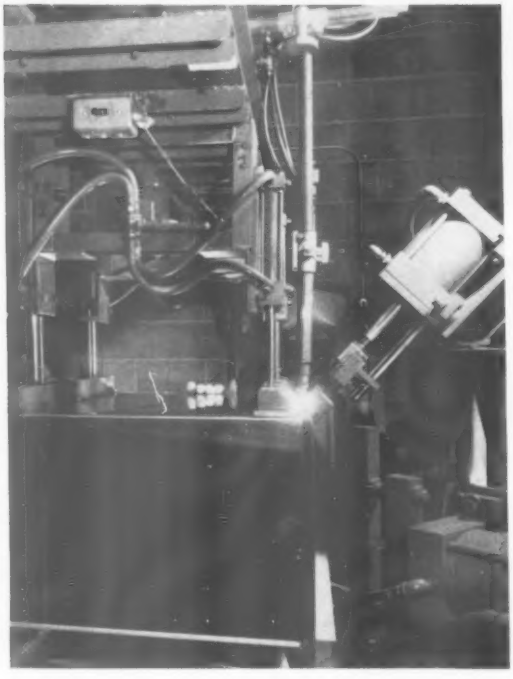
AUTOMATIC welding speeds production in dishwasher fabrication.





ABOVE: Close-up of Tig welder in action. BELOW: Welding tank seams.

Tig welding+ know-how= dishwashers

By R. C. Hull and Glenn Hartwick*

THE Kitchen Machine Div. of Toledo Scale Co., Rochester, N. Y., is producing an electric dishwasher with the aid of automatic welding.

The pushbutton-controlled dishwasher is fabricated with greater quality and reduced costs through the use of Tig (tungsten inert-gas) welding.

Sixteen-gage 18-8 (type 302) stainless steel is the material used in the dishwasher. The tank measures 30 x 30 in. by 16 in. deep. The two ends are assembled to form a U-shaped section, and three seams must then be welded on each side.

The automatically welded butt joint replaces a manual metal arc lap joint and a soldered fillet.

Mounted on a radiagraph unit, the welding head is powered by a 300-amp machine. A combined control panel switches on welding head, argon shielding gas supply, water coolant, high-frequency exciter, and welding current.

A main frame supporting a water-cooled chill bar frame acts as the welding fixture. To this frame the wrap-around and two sides are clamped with an approximate 4-ton pressure.

Overhead, on a truss, hang the radiagraph and welding head. The three seams are welded as the fixture pivots through 180 deg.

The use of the automatic Tig process results in improved weld quality, elimination of grinding, and 60% time reduction.

Mr. Hall is supervisor of the Methods Dept., Toledo Scale Co. Mr. Harwick is technical representative for Air Reduction Sales Co., Buffalo district.

SUCCESSFULLY BRAZED WITH

Here's a brazing job that was no easy problem. It is being done now successfully thanks to the engineering ingenuity of Southwestern Engineering Company personnel. This is a "first" for this type of brazing operation on the West Coast. Twenty-four of these heat exchangers are already in service in Texas oil fields and many more will follow.

The tube sheets are for large diameter exchangers. Brass plate, ⅜" thick, is brazed to 3¾" thick steel plate with .005 x 6" Silvaloy 45 and APW Black Flux. Furnace heating was used.

Silvaloy Brazing Alloys and APW Fluxes are helping to speed production, lower costs and improve brazing results in many fields. Call your nearest Silvaloy Distributor for information or technical assistance. ★ ★

SWECO

SOUTHWESTERN ENGINEERING COMPANY

Southwestern Engineering Company, designers and manufacturers of heat exchangers, pressure vessels and special fabricated equipment for the process industries. ★ ★ ★ ★

Two complete reference manuals for low temperature silver brazing and fluxing are available upon request. Send for either one or both. ★ ★ ★ ★

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also HARDEX—new low hydrogen, hard surfacing electrodes
WELDING MACHINES
AUTOMATIC — constant voltage, for semi- and full-automatic welding
MANUAL — light or heavy duty, portable or stationary
ACCESSORIES Holders, helmets, gloves, cable, etc.
fine quality, prompt service— local rep's phone
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G H
I J
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O P
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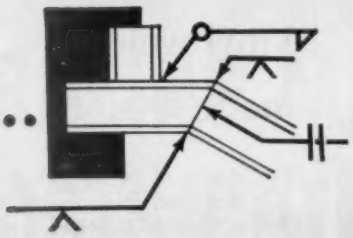


the welding clinic

Here you may find the solution to your welding problems, whether they concern design, production, construction or maintenance welding. Submit your questions for answering on this page.

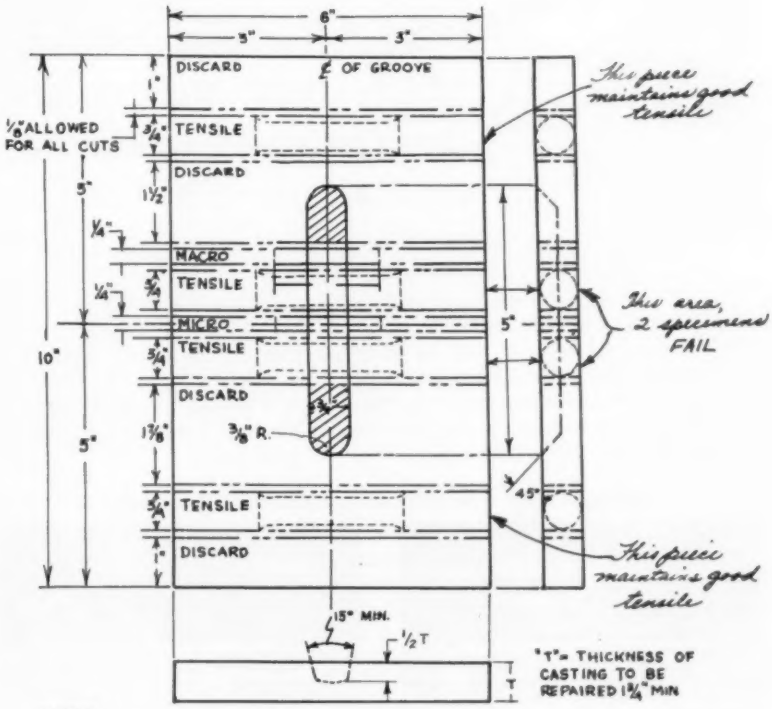
Following Navy specifications on castings

Question:

We have been attempting to repair "G" or Gun Metal castings to comply with Navy specifications. We have tried to maintain color match, 40,000 psi tensile and 20% elongation—and have had very little success. Possibly you could offer a solution to our problem.

Chemical analysis follows:

Copper	87.32
Tin	8.76
Lead	0.16
Zinc	3.66
Nickel	0.02
Phos.	0.02
FE	0.06



NOTES:
1. TENSILE SPECIMENS TO BE IN ACCORDANCE WITH TYPE SPECIMEN AS SHOWN IN GENERAL SPECIFICATIONS FOR INSPECTION OF MATERIAL, APPENDIX II, PART A
2. ALL SPECIMENS TO BE REMOVED AFTER X-RAYING.

Answer:

You have an alloy which is very difficult to weld; especially to meet Navy requirements. Other companies confronted with the problem have encountered considerable difficulties despite having tried many welding procedures.

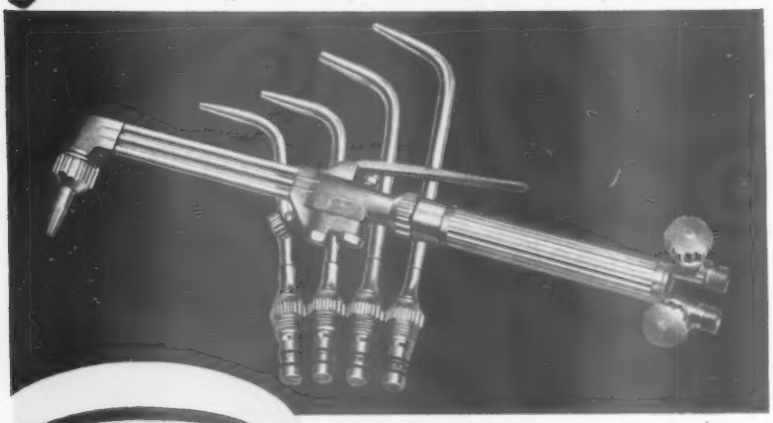
Here is a quotation from one of the authorities whom we contacted in regard to your problem.

"Personally, I have never seen a test plate and specimens similar to the one shown on the enclosure. Apparently, .505 in. tensile specimens are taken across the weld which is made in a groove. Half of the welded area is base plate. They not only secure their tensile values from this bar but also must take elongation in 2 in. across the joint. Such a measurement of ductility is never accurate. In fact, elongation measured across a joint in a flat tensile specimen is never accepted for any type of specification work. We do not believe it would be possible to pass the 20% elongation in 2 in., which they show in their specification.

"Logically, such a test plate should be welded with E CU Sn C electrodes which are phosphor bronze Grade C, having a nominal tin content of 7.0-9.0%. Obviously, the lead and zinc will cause porosity in the weld deposit and at fusion line between weld deposit and base plate.

"The only way we see to put in a halfway decent weld would be to use the phosphor bronze Grade C electrodes, preheating and maintaining an interpass temperature of 400 F, use fast string beads and hot peen the deposit as soon as slag is removed. If such a procedure is used the weld deposit should be the highest in quality attainable in this cast alloy."

Light, handy Torch does multiple jobs...cuts, welds, heats, brazes, solders



SMITH'S

"PIPELINER" Welding Torch and Cutting Assembly ...with slip-in tips

Developed originally for pipeline welders, this popular little guy has been drafted for all kinds of other uses. You can do welding from 1/32" to 1/4", and brazing and heating jobs. Eight other sizes of Soft-Flame tips increase welding capacity to 7/8". With the cutting assembly you can burn steel from 1/8" to 4" in thickness —clean, high speed cuts with minimum gas consumption. Insert special tips and you can do heavy scarfing, rivet washing and gouging. Tips slip in, tighten with finger twist (no wrench needed). Operators really like that handy 2 lb. weight! Over-all length 16". Your choice 90° or 75° head angle.

SPECIAL TIPS MULTIPLY THE JOBS YOU CAN DO

FOR GENERAL CUTTING. This series gives full range of work from 1/8" to 4". Ideal for pipe cutting and beveling, general production cutting, maintenance and repair jobs of all kinds.

GOUGING TIP. Used for gouging old welds and cracks in steel. Works equally well for deep gouges at minimum width or shallow grooves with considerable width.

"METALEATER" TIP for scarfing and metal washing, rivet washing and removal of stay bolts. Has heavy preheat and will remove a lot of metal fast.

FOR PLATE CUTTING. Two tips in this series will cut sheets and plates from 10 ga. to 1/2". Light preheat. Clean straight-line cuts with minimum gas consumption.

Full information on request — mail coupon

SMITH WELDING EQUIPMENT CORP.

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Vinyl welding made easier

WELDING of plastic covered steel has been facilitated by special electronic controls which permit a projection weld to be made in one milli-second.

Magnetic force welding machines and treatment of the material to which a vinyl metal laminate is to be joined allows Arvin Industries, Inc., Columbus, Ind., developer of the laminate, to weld it to other metal pieces of any size, shape, and like gage.

Laminate Advantages

Vinyl metal laminates are suited to many product uses because they are resistant to abrasion, corrosion, and chemicals. Painting and drying operations can be bypassed and base metals can be thinner. Because of the unlimited designs available and the new welding and drawing techniques, vinyl metal laminates can be incorporated when decorative finishes are desired.

When normal electrical resistance welding was employed on "Arvinyl", the heat generated in the weld zone caused the plastic to melt and run; this left a defaced surface and voided advantages of coating metals before fabrication.

Consultation with Precision Welder and Flexopress Corp., Cincinnati, led to a new approach.

Microsecond Cycle

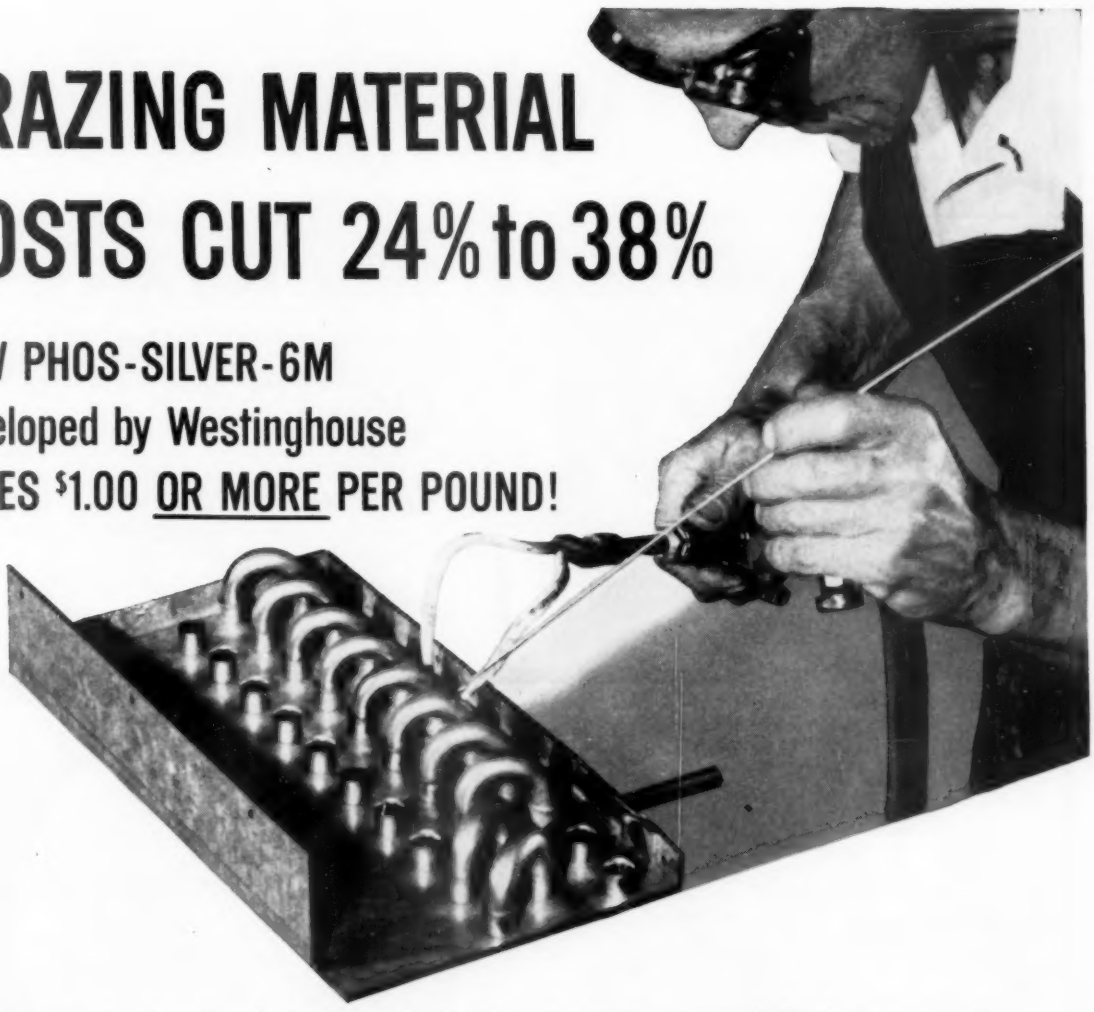
While Robotron Corp., in Detroit was developing controls which permit a welding cycle of only a few microseconds, Arvin and Precision engineers experimented with weld methods suitable for a fast cycle.

"We finally decided that projection welding offered the most hope of success of obtaining high strength welds," said William G. Morgan, Arvin's welding engineer. The process, under magnetic force, was refined with the new controls until the most satisfactory cycle—one millisecond—was reached.

With the technique now in operation, vinyl-clad steels are being used in new automobiles, television and various cased products.

BRAZING MATERIAL COSTS CUT 24% to 38%

NEW PHOS-SILVER-6M developed by Westinghouse SAVES $1.00 OR MORE PER POUND!



There is now a brazing alloy *thoroughly proving* itself *actually superior* to brazing materials costing *3 and 4 times as much!*

It is the great, new Phos-Silver-6M—created to cut manufacturing costs throughout vast Westinghouse operations—and now available through your Westinghouse Sales Office, or your local Westinghouse Welding Distributor!

Extrusion eliminates oxides!

Phos-Silver-6M is made by unique, *extrusion* methods, blanketed under *inert gas!* This *prevents* the oxides that cause most brazing troubles. And produces *new versatility* in a brazing rod, with *exceptional* flow characteristics, *remarkable* ductility, and *unsurpassed* appearance of the finished work!

Production proved! Analysis certified!

Moreover, Phos-Silver-6M (as *all* the new Westinghouse alloys), has been *completely* proved, throughout stringent laboratory testing, shop tests and production runs! Then, it is now ANALYSIS CERTIFIED!—*assuring you* the *same consistent, best possible* brazing results!

Order *trial* packages NOW! You'll *standardize* on Westinghouse Brazing Materials TOMORROW! J-22082

YOU CAN BE SURE...IF IT'S

Westinghouse

This exclusive Westinghouse Seal *"guarantees"* you the *correct* formulation of *every rod!*

Convenient packaging, 18" lengths, 1-lb and 5-lb tubes. Standard 25-lb package, 36" lengths.

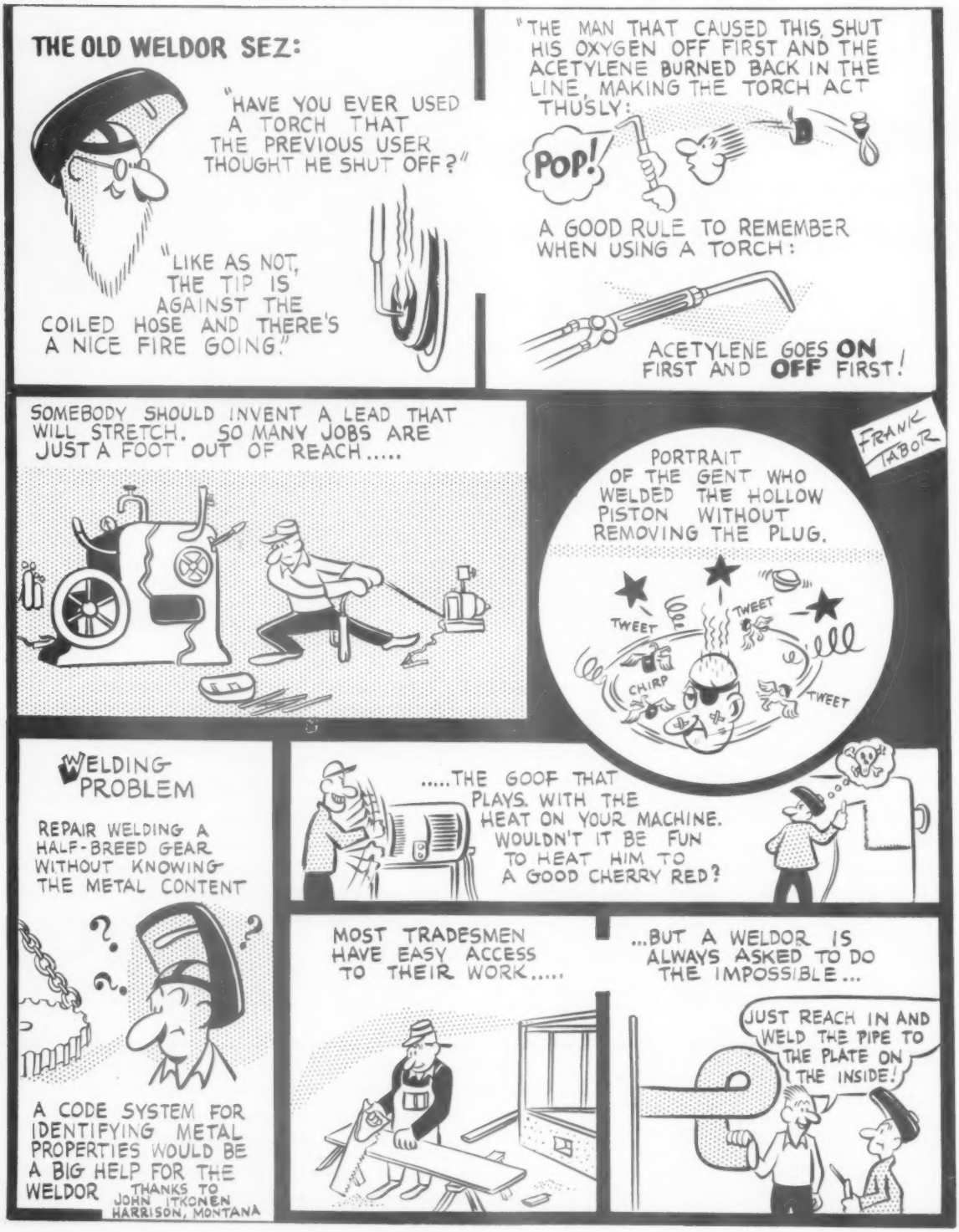
Select from the Westinghouse MOST COMPLETE LINE OF BRAZING MATERIALS IN THE INDUSTRY!

Phos-Copper® Phos-Silver #2 Phos-Silver* Phos-Silver-6M Phos-Silver-15

Westinghouse round, extruded rods give approximately 20% *more feet per pound* than square rods of the same diameter! (Same alloys are also available in rod form, wire in coils, or rings.)

***POWER-UP* with Westinghouse *advanced* brazing materials!** *Trade-Mark

A WELDOR'S WOES


THE OLD WELDOR SEZ:
"HAVE YOU EVER USED A TORCH THAT THE PREVIOUS USER THOUGHT HE SHUT OFF?"
"LIKE AS NOT, THE TIP IS AGAINST THE COILED HOSE AND THERE'S A NICE FIRE GOING."
"THE MAN THAT CAUSED THIS, SHUT HIS OXYGEN OFF FIRST AND THE ACETYLENE BURNED BACK IN THE LINE, MAKING THE TORCH ACT THUSLY:
POP!
A GOOD RULE TO REMEMBER WHEN USING A TORCH:
ACETYLENE GOES ON FIRST AND OFF FIRST!
SOMEBODY SHOULD INVENT A LEAD THAT WILL STRETCH. SO MANY JOBS ARE JUST A FOOT OUT OF REACH.....
FRANK TABOR
PORTRAIT OF THE GENT WHO WELDED THE HOLLOW PISTON WITHOUT REMOVING THE PLUG.
TWEET
TWEET
CHIRP
TWEET
WELDING PROBLEM
REPAIR WELDING A HALF-BREED GEAR WITHOUT KNOWING THE METAL CONTENT
A CODE SYSTEM FOR IDENTIFYING METAL PROPERTIES WOULD BE A BIG HELP FOR THE WELDOR
THANKS TO JOHN ITKONEN HARRISON, MONTANA
.....THE GOOF THAT PLAYS WITH THE HEAT ON YOUR MACHINE. WOULDN'T IT BE FUN TO HEAT HIM TO A GOOD CHERRY RED?
MOST TRADESMEN HAVE EASY ACCESS TO THEIR WORK.....
...BUT A WELDOR IS ALWAYS ASKED TO DO THE IMPOSSIBLE...
JUST REACH IN AND WELD THE PIPE TO THE PLATE ON THE INSIDE!

PAGE offers 3 big advantages

PAGE has unsurpassed facilities, experience and special skills for drawing and furnishing the right wire for your welding applications. We are ideally equipped to manufacture wire to any desired size, temper or surface finish.

We purchase our raw materials to rigid specifications; we select heats of steels for optimum characteristics—then, upon delivery and before processing, we analyze samples for conformity with our specifications. Thus, PAGE is *the one supplier* in a perfect position to control the chemical and physical properties of its product *from billet to rod to wire!*

1 Wire to Fill Your Needs —Wide Analysis Range

The PAGE line contains 26 *different analyses*, covering the field of applications: heavy automatic submerged arc...light manual submerged arc...inert gas manual ...automatic, tungsten or metal arc.

AUTOMATIC WELDING WIRE

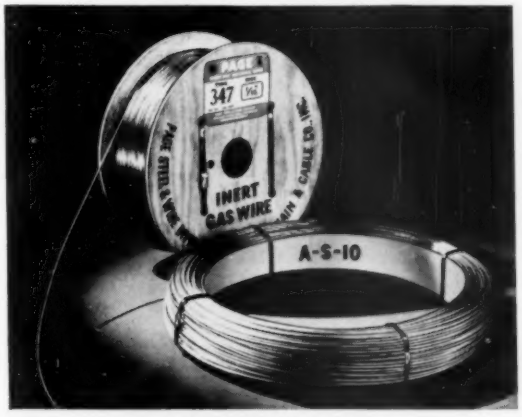
CARBON STEEL...Any carbon from Armco (.025 max.) to high carbon (.70-.84)

LOW ALLOYS...All the most popular welding grades

STAINLESS...All standard AISI grades. Other types on request

GAS WELDING RODS

PAGE Gas Welding Rods have long been recognized as the standard of quality, uniformity and dependable performance. These rods, in an exceptionally wide range, are furnished in coils, on reels or in 36-inch lengths, in the following materials: medium or high carbon steel, mild steel, Armco, low alloy, stainless steel, manganese bronze, naval bronze.



BARE ELECTRODES

PAGE Bare Electrodes are available in any carbon from Armco to high carbon (.70-.84).

METAL SPRAY WIRE

PAGE Metal Spray Wire is supplied in: any carbon from Armco to .80 carbon, low alloy, stainless steel, manganese bronze, naval bronze.

2 PAGE Packaging Means Protection and Convenience

Wrapped Coils... Coils in Cartons

Single and palletized coils, each coil steel-strapped and wrapped in waterproof paper...Also, single and palletized coils, in individual cartons.

Handy Reels

PAGE Inert Gas Welding Wire is available on 25-lb., nonreturnable palletized reels to fit all popular inert-gas welding machines. Wire is precision thread-wound.

Pay-off-paks & Leverpaks

PAGE *Pay-off-paks* permit *continuous feeding of wire up to 600 lbs.* (from 20" *Pak*) *or 850 lbs.* (from 23" *Pak*) *without rethreading.* Both *Pay-off-paks* and lightweight *Leverpaks* (*not illustrated*) give protection against distortion and corrosion...are easily opened, resealed, handled, stored. Palletized when requested.

Welding Wire in Coils

PAGE A-S Automatic Welding Wire is regularly furnished in layer-wound coils with cardboard liner, four Signode straps for easy coiling and unwinding —palletized as necessary.

Gas Rod Packing

PAGE Gas Welding Rods are supplied in 36" lengths in 50-lb. bundles, paper and burlap-wrapped. Also in burlap-wrapped coils and 150-lb. (approx.) reels. Stainless rods also available in 10-lb. fibre-board cartons.

3 Prompt Delivery from Local Stocks

PAGE automatic arc welding wire and oxy-acetylene welding rods are readily available from PAGE warehouses shown at bottom of this page—and from a nearby PAGE Distributor, wherever you live. Your PAGE Distributor saves you time by filling your needs promptly from his stock. This helps keep your inventory investment down!

ACCO for Better Values

**Indicates PAGE warehouse stocks*

Send for These...

- **Folder DH-402A** • PAGE Submerged Arc and Inert Gas Welding Wire
- **Booklet DH-1277** • PAGE Gas Welding Rods
- **Welding Rod Comparison Chart**

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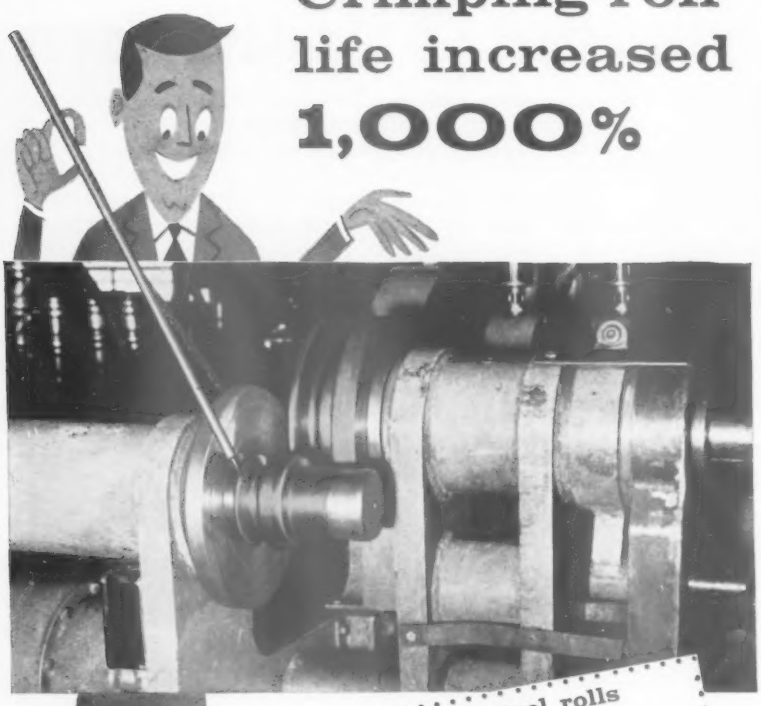
ACCO

Crimping-roll life increased 1,000%



High-carbon steel rolls overlaid with AMPCO TRODE 300 Aluminum-Bronze Electrode

In forming irrigation couplers and sprinkler outlets, crimping rolls had to be replaced every 7,000 pieces. Metal-to-metal wear was severe.

But then, mandrel and wheel were overlaid with Ampco-Trode 300. 70,000 pieces had been produced at the time the picture above was taken, and the male and female rolls were still going strong.

Scrap losses were practically eliminated. So were scratching and galling — reworking costs went down substantially.

Can you enjoy similar savings on *your* drawing and forming operations? Talk it over with your nearby Ampco distributor. Or mail coupon below today.

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SUBMERGED—arc and Tig heads on same track.

Two welders are . . .

Twin helpers

WELDORS who walk into Mojonnier Bros. Co., Chicago, Ill., are *not* seeing double. Those submerged-arc and Tig welding heads *are* traveling on the same track.

P. T. Moon, project engineer, sought efficient, yet fast fabrication on equipment manufactured by the food processing company. Using a special fixture built by Cecil C. Peck Co., Cleveland, Mr. Moon is able to select the best method for welding longitudinal seams in cylinders, cones, and flat stainless steel sheets of different thicknesses.

Submerged-Arc Head

Stainless steels in 12, 14, or 16 gage are Tig-welded, using argon shielding. Speeds range from 18 to 25 in. per minute. Linde Co. equipment is also used when working on heavier gages with the submerged-arc process. On this thicker material the head moves from 60 to 90 in. per minute.

A box girder which parallels the seams supports the carriage-mounted welding heads. This method produces straight butt welds up to 10 ft long on flat stock or on a preformed shell.

Foot Controlled Welding

The steel is cooled by a water-cooled copper backing strip to which the workpiece is clamped. A foot switch controls welding speed.

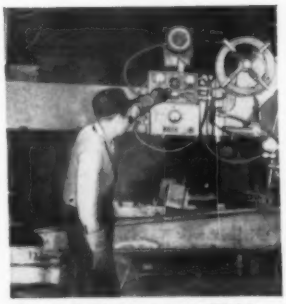
The firm has found that the two mechanized welding processes produce high-quality welds in minimum time and in minimum space. Labor costs have dropped because material handling and setup time have been cut drastically by the unique arrangement.

UNIONMELT Welding
makes rugged seams for rugged machines

Tough and heavy road-building machines are no stronger than the welds that hold their working parts together. Making sound joints in thick steel is a job made to order for LINDE's UNIONMELT Submerged Melt Electric Welding.

Using UNIONMELT Welding, you get dense, deep welds in metal up to 1½ inches thick in a single pass. There's no limit to thicknesses you can join with multiple passes. Welds are uniformly clean and smooth. With the right combination of UNIONMELT Composition and welding rod, alloy steels and even non-ferrous alloys can be welded as easily as steel—manually or automatically.

Get all the facts about UNIONMELT Welding, and LINDE's other modern welding methods. For a free copy of the booklet, "Modern Methods of Joining Metals," address Dept. WE-9, LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N.Y. *In Canada:* Linde Company, Division of Union Carbide Canada Limited.



LINDE's UNIONMELT Welding gives dense, sound welds in light-gage or heavy metals, at high speeds, automatically or manually.

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The terms "Linde," "Unionmelt," and "Union Carbide" are registered trade-marks of Union Carbide Corporation.

Architects and engineers discover that building is no chore as . . .

Welding gives greater space for rocket plant

By Omer Blodgett
Design Consultant
Lincoln Electric Co.

WELDING is playing a large role in the construction of a 185,000 sq ft building in California.

Being built for Rocketdyne Div. of North American Aviation, Inc., the plant was designed to absorb earthquakes, yet minimize obstructions in housing a staff of 4,000.

Kenneth H. Neptune, architect, and Richard R. Bradshaw, structural engineer, chose welding as the process to join structural members for a maximum of strength and a minimum of weight and cost.

Flexibility and a relatively free work area were uppermost in the planner's minds when they decided to use arc welding on tapered girders in the form of gable bents covering five bays with 56 ft spans.

Girders are cut diagonally from a single wide sheet. This forms two tapered webs. Flanges are submerged-arc welded to the upper and lower sections of the webs. The girders, with sloping flanges on top, are positioned so that they meet at the top. This forms a gable bent which, besides aiding drainage, carries lateral and vertical loads.

(A variation on this is the "saw-tooth" roof. In this roof the girders are placed with the flat flange on top, giving the appearance of a saw. Skylight walls on the high side of the girder bays give good illumination.)

Pipe Supports

Gable bents are supported by 6 in. pipe columns at girder ends. Truscon open-web bar joists, spaced 7 ft apart, run transversely to the top flanges. Their top chords are arc welded to the girder's top flanges. The open webbing and lower chords extend below the line of the sloping girder flanges.

Bulb tee purlins (horizontal members supporting girders) run across the joists and parallel to the girder on about 2 ft centers. These are welded to joist chords and extend beyond the front wall to form a framework to be used as a protective canopy for the office area.

The roof over factory area is steel decking in 7 ft widths, welded to the purlins. Original design live-load for this was 20 lb per sq ft, but building code requirements called for a reduction to 12 lb per sq ft. Several bridge cranes with rated capacities up to 7½ tons are suspended from the lower flanges of the tapered girders.

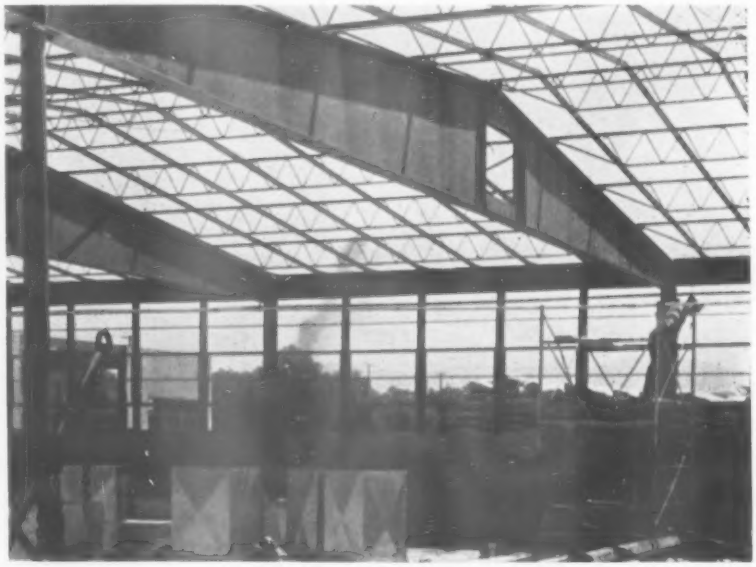
Field Welding

Girders were shop fabricated. But most connections to joists, purlins, etc., were welded in the field. A battery of portable 200-amp, 40-volt generators driven by gasoline engines produced power for the welding.

The large, rectangular cutouts seen at the center of each tapered girder were installed to receive air-conditioning ducts. Reinforcing ribs were welded to girder webs around these openings.

The flat roof over office area is poured gypsum, known as "Pyrofill." It acts as a diaphragm to absorb earthquake shocks. Between roof and steel framing is placed a layer of spun glass to act as insulation. Plate straps are used on the factory roof deck for added protection.

Wall sections are panels of 6 in. precast concrete. The panels surround a continuous line of steel window sash.



DETAIL of construction in California rocket plant. Girder web is solid piece. Both web and bottom flange (chord) help take pressure from overhead. Plant was built to provide maximum space while housing 4,000 persons.

50 YEARS of QUALITY and PROTECTION by

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No. 602-3-C with #1085
Insulated Steel Glass Holder

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Insulated Dowmetal Lift-Front Glass Holder

FIBRE and FIBERGLAS* HELMETS

Inside view showing INNER BIB of Series "600" Helmets for extra protection to welder's neck from flashes and reflected glare.

New Series "400" Helmets. Smaller size for close quarter work.

*OWENS-CORNING TRADE MARK

Safety and comfort mean *more* welding . . . more production per day! Fibre-Metal engineering has for 50 years kept these "qualities" uppermost in mind . . . for more and better *work ability* by the welder.

Fibre-Metal's Helmets of Fibre *or* Fiberglas* are light, durably resistant to impact and hard use. They feature seamless compression-molded shells, beaded edges for strength and safety, Wide Range Headsize Adjustment, new 4-Position Helmet Stop, and provide for four popular glass holder styles. Adjustable friction joints hold helmet in any position.

Fibre-Metal Features:

LIGHT WEIGHT • EXCEPTIONAL STRENGTH • MOISTUREPROOF NON-WARPING • HEAT RESISTANT (SELF EXTINGUISHING) EASILY STERILIZED

When buying any welding equipment . . . always ask for a FIBRE-METAL product!

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PROFIT-ABLE PROTECTIVE PRODUCTS SINCE 1905

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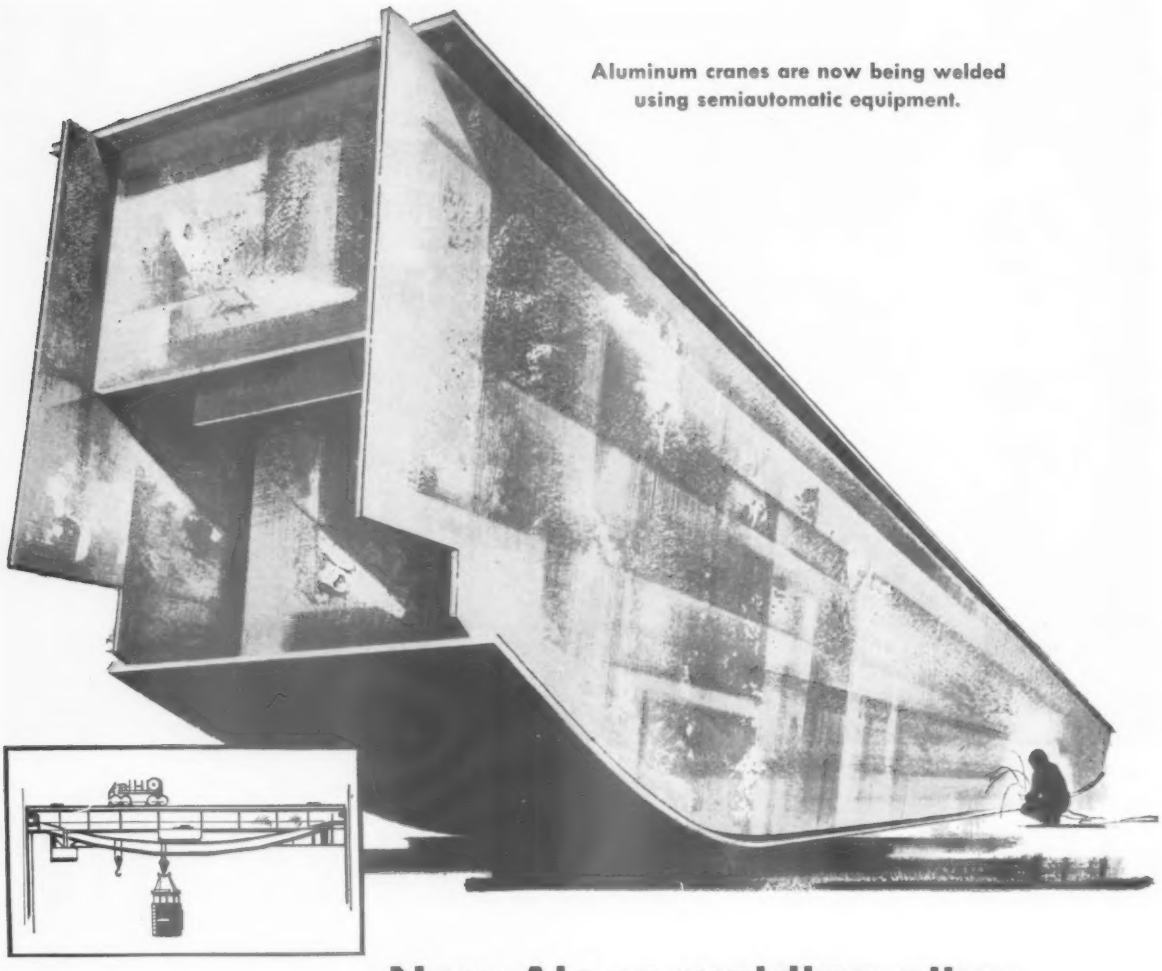

Aluminum cranes are now being welded using semiautomatic equipment.

New Alcoa welding alloy makes possible the aluminum crane

For a long time, the idea of an aluminum crane has interested designers. Much lighter in weight, it would permit lower cost building foundations or a higher capacity crane on the same foundations. But how to make it? Riveted construction is outmoded and expensive.

Now aluminum cranes are being built, thanks to a new Alcoa alloy. Designated 5456, this new alloy has the highest as-welded strength of any commercial aluminum alloy yet developed. Guaranteed minimum properties are 42,000 psi ultimate and 19,000 psi yield on the plate and equally good ultimate strength across the weld.

Using the new alloy and the inert-gas consumable-electrode process, it costs no more to fabricate aluminum cranes than steel cranes. There are long welding runs involved, up to 60 feet, and semiautomatic equipment is used. Speeds as high as 80″ per minute are achieved.

In addition to their light weight, these aluminum cranes can be used in corrosive atmospheres and will require no painting.

Alcoa is headquarters for fresh and exciting ideas like this on how to weld, braze or solder aluminum. Get in touch with an Alcoa distributor listed at right. And write now for booklets and films that show how easy it is to weld, braze and solder aluminum. Aluminum Company of America, 1740-J Alcoa Building, Pittsburgh 19, Pa.

THE ALCOA HOUR—Television's Finest Live Drama
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Your Guide to the Best in Aluminum Value

Want technical help in welding, brazing or soldering aluminum? Contact your Alcoa sales office, listed under "Aluminum" in the Yellow Pages of your phone book.

For immediate delivery of Alcoa welding products, call your Alcoa outlet listed below. He carries a complete range of alloys and sizes.

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Bluefield
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WISCONSIN
Milwaukee
Machinery & Welder Corp.

SPREADING hardfacing paste.

FUSING to blade with torch.

EDGE completed, ready to mount.

Wondering how to increase life of your tools? Here's an answer, and it's found . . .

Down on the farm

A FARM colony in southern Alberta, Canada, has discovered what industry has long known—hardfacing is an economical way to extend usefulness of valuable equipment.

Jacob Mandel, manager of the Monarch Colony's 4,000 acres of land and approximately 200 head of cattle, saves 58% of his cultivator shovel budget by hardfacing cutting edges.

Mr. Mandel estimates that hardfacing gives three times greater wear than an untreated shovel. Doing the work in the farm's welding shop costs only five dollars for each of the three blades.

Saving Analysis

A new set of blades costs $56. Hardfacing entails an additional expenditure of $15. However, by hardfacing, service life of the blades is increased 66%. Since an additional two blades (at $112) would have to be purchased to achieve the same work life, Mr. Mandel saves $97 for the farm.

Hardfacing at the colony is not designed to reclaim blades; rather it is intended to prolong the use of the original blades. When the blade has worn enough to indicate replacement, it is usually too narrow for additional work and is replaced by another hardfaced part.

Hardfacing Method

A paste type-hardfacing alloy containing chromium borides is used by the colony for the hardfacing process. Manufactured by Wall Colmonoy Corp., Detroit, the hardfacing material is easy to apply, yet gives a wear resistant surface.

Paste offers a simple hardfacing method. Mr. Mandel applies it to the bottom side of the cutivator shovel blade to a depth of 1¼ in. The alloy is easily brushed on, or spread, using a knife or spatula. Blades shown here are 43 in. long on each cutting edge with a 70-deg angle between the two.

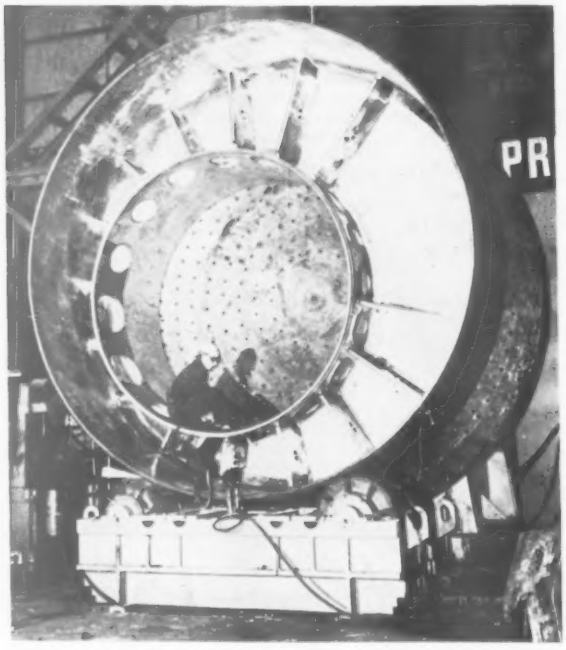
When the paste has air-dried it is fused to the base metal with an oxyacetylene flame. The blade is now ready for installation on the machine.

Originally introduced for farm purposes in plowshares, hardfacing is gaining more and more advocates for further use on other cutting and breaking tools. Reapers, harrows, and rakes are only a few of the machines on which hardfacing is used as a means of increasing durability and cutting costs.

STUD welding is replacing bolts in securing cover plates on commercial dry cleaning machinery. Sheet metal templates are used to locate the Nelson standard threaded studs at most points; although the Vic Cleaning Machine Co., Minneapolis, which fabricates the machinery, sometimes employs actual cover plates to direct center-punch marks. Studs are $\frac{3}{8}$-in. in diameter and either 1 or 2-in. long. They are end welded from only one side of the base. This eliminates the difficult hand welding operation that had to be done on bolts.

On the job . . .

WELDMENTS are made automatically on this Worthington positioner, which has two planes of motion. Used in Combustion Engineering's Nuclear Components Fabricating Department in Chattanooga, Tenn., the positioner here is holding a part of a fast breeder reactor vessel. When the vessel has been fabricated it will be capable of producing low cost power. Low costs are possible because the plant in which it will be installed converts U-238 into plutonium faster than fissionable fuel is consumed. The positioner is equipped with electronic variable tilt and rotation speeds. When completed, the vessel, as well as internals and a rotating plug will be installed at the new 100,000 kw Enrico Fermi plant being built near Detroit.



BANJOS, banjo covers, and flanges are Mig welded with CO_2 shielding gas. These are components for Ford Motor Co. axle housings. The Westinghouse set-up at work here is automatic. The powdered flux of submerged-arc is replaced by a jet of CO_2 which forces contaminated atmosphere from the weld area. With elimination of flux, welding speeds are increased and material expenditures are from 10-25% lower. It is thought that this is the first time the process has been used on a full scale, highly automated line.

P&H now offers an outstanding improved E6010 Electrode

...to give you fast burn-off in all positions, for all purposes!

Here's the latest development in welding electrodes —P&H AP-100—a new improved mild steel all-purpose, all-position E6010 electrode with iron powder.

Arc characteristics are greatly improved. When whipping the electrode there is no tendency for the arc to snuff out. Vertical welds are easier, and free from holes. The weld bead is exceptionally smooth and evenly rippled. Weld quality is excellent, both for x-ray and mechanical properties.

Arc-force stays constant as the electrode burns, reducing stub loss. This, plus higher amperages, greatly increases deposition.

For more information about this remarkable new electrode, write to Dept. 321B, Harnischfeger Corp., Milwaukee 46, Wisconsin.

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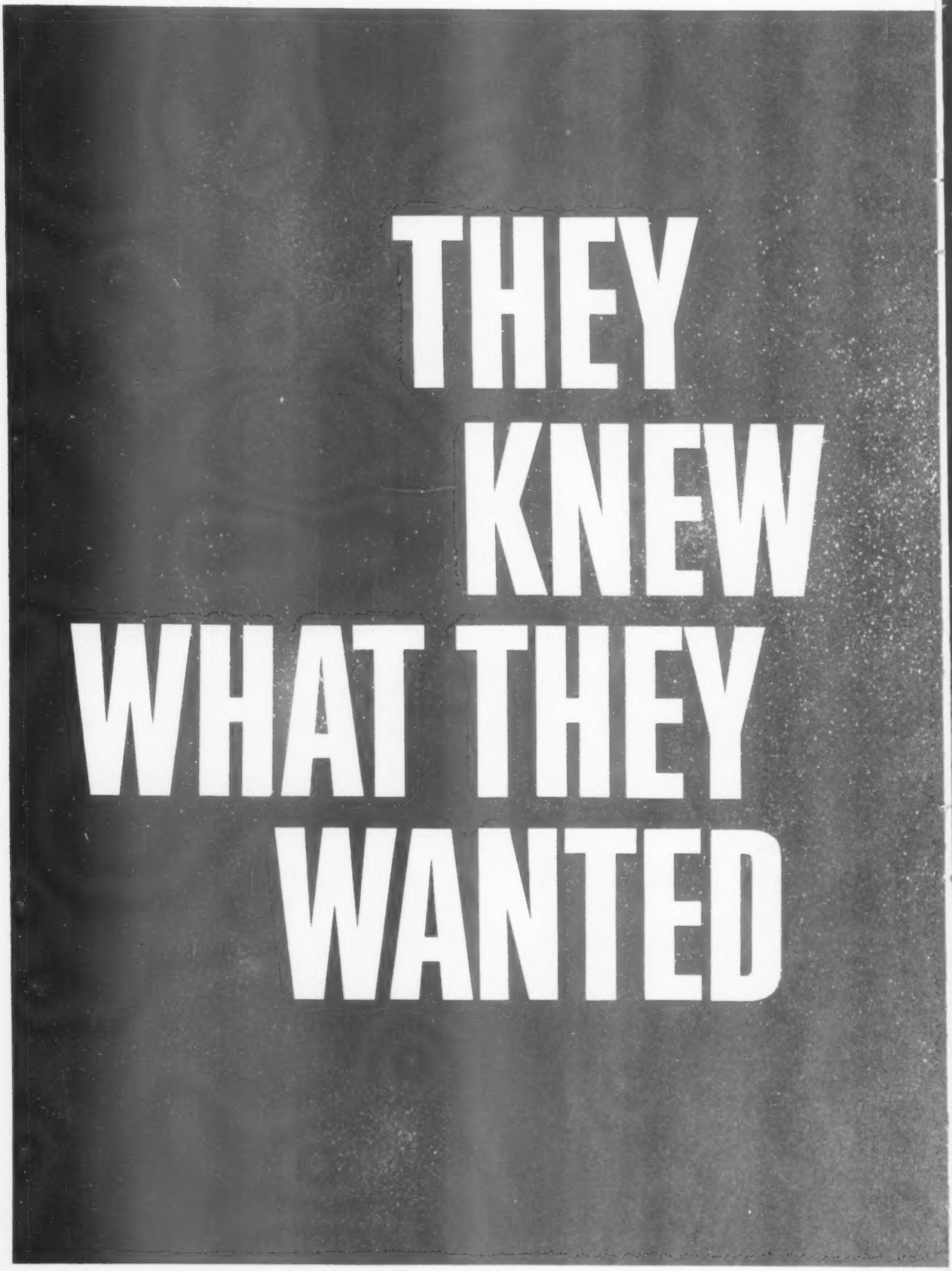
THEY
KNEW
WHAT THEY
WANTED

What's the best basis on which to build sound, mutually profitable distributor-manufacturer relationships?

Here's how A. O. Smith and their welding products distributors answer that question.

A. O. SMITH KNEW WHAT THEY WANTED when they set out to build an effective, highly integrated distributor network. They wanted quality, not quantity . . . aggressive, flexible distributor organizations with solid experience handling welding products. They wanted congenial, continuing relationships . . . the happy collaboration of good men whose success is based on a foundation of fair business dealings.

A. O. Smith found what they wanted in their present distributor network. Each organization is well founded in all phases of welding. Distributor sales representatives are highly trained . . . qualified to serve as extensions of the Corporation's own selling force. Adequately blanketing individual marketing areas, these welding products distributors reflect A. O. Smith's own reputation for integrity and sound practice.

THE DISTRIBUTORS KNEW WHAT THEY WANTED when they joined forces with A. O. Smith. They wanted to work with the leader in welding development — a large manufacturer, but not "too big" to react to distributor needs and problems. They wanted a full line of quality electrodes, welding machines and accessories. And, of course, they wanted a mutually beneficial profit arrangement, free of trick clauses or bias.

The distributors got what they wanted. With A. O. Smith, they have a complete welding product line to sell — more than 70 types of electrodes . . . more than 30 welding machine models . . . wide selection of accessories, from cable connectors to dry rod ovens. With A. O. Smith, they're backed by a diversified $200-million-plus corporation, itself one of the world's largest users of welding for production. They're backed by progress-pacing research which dates from the invention of the first truly practical shielded arc welding electrodes and by countless other "firsts."

Is this what you want?

If you think you're qualified to be an A. O. Smith distributor, write Welding Products Division, Dept. RNS, A. O. Smith Corporation, Milwaukee 1, Wisconsin

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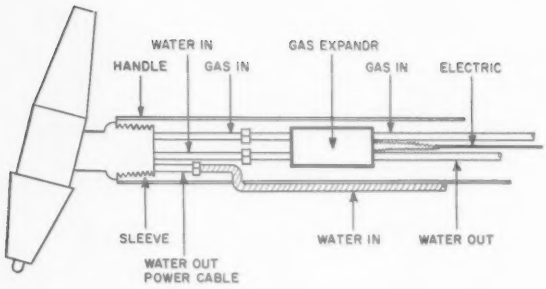
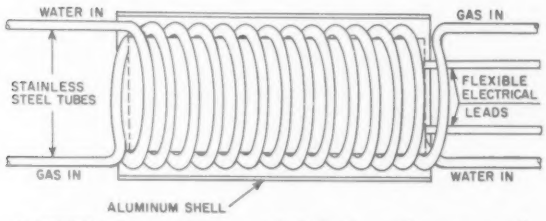
Small expander unit promises savings in inert gases





SKETCH above shows exploded view of gas-expanding device. Its position in torch handle is illustrated at left.

By G. C. Berg and E. E. Stolp, Jr.*

THE CONSTANTLY INCREASING demand for faster, improved welding methods has in recent years been answered by the extensive use of the Mig (metal inert-gas) and the Tig (tungsten inert-gas) welding processes for joining ferrous, non-ferrous and dissimilar metals. But these processes themselves bring new problems, one of which is cost.

One answer is economical control and reduced costs of shielding media, which can be achieved by applying a basic law of gas behavior.

Charles' Law states that the volume of gas is directly proportional to its temperature and pressure. By applying this law to inert-gas welding, an economy of 50% to 100% in gas usage and cost can be obtained.

Gas Is Expanded

With the addition to welding equipment of a unit known as the "Gas-X-Pandr," the protective gas is heated and expanded before being applied to the work. This is said to give a better, smoother weld and a greater savings in gas consumed.

The gas-saving unit is constructed of two stainless steel tubes formed tightly around a General Electric cartridge heater and enclosed in a light aluminum casing. This casing fits into hand torches of all makes.

The inner coil carries the gas to expand; the outer coil carries the coolant which keeps the shell at a temperature comfortable enough for the operator to handle.

The unit operates at 110-220 volts or on special voltages of a-c or d-c. It develops heat of approximately 1,200 F which expands the gas to greater than 150% of its normal protective capacity.

Simplicity of design makes the unit easily adaptable to all hand torches and most stationary and semiportable welding equipment.

Claim Great Savings

Actual operating tests by users have shown that aforementioned savings of 50-100% can be realized. One user reports that "Normal method (without expansion) on either stainless or aluminum when using helium as a protective atmosphere: 116 ft of weld per hour per cubic foot of gas was obtained. When using argon in the same application, 176 ft of weld per hour per cubic foot of gas was obtained."

By application of Charles' Law with the expander unit, the following results were obtained: Helium—213 ft of weld per hour per cubic foot of gas used; argon—307 ft of weld per hour per cubic foot of gas.

Another user claimed that a welding job on stainless-steel aircraft parts under the normal method requires 35 cfh of helium. This is cut to 5 cfh through use of the unit. Using argon, the normal method requires 40 cfh. This is cut to 20 cfh when using the "Gas-X-Pandr."

UNIT is coupled to Tig torch head. At right are cartridge heaters used in expansion device.

* *Mr. Berg is president of H.I.G. Corp., Chicago. Mr. Stolp is with the Apparatus Sales Division of General Electric Co.*

100% X-rayed...100% X-ray sound

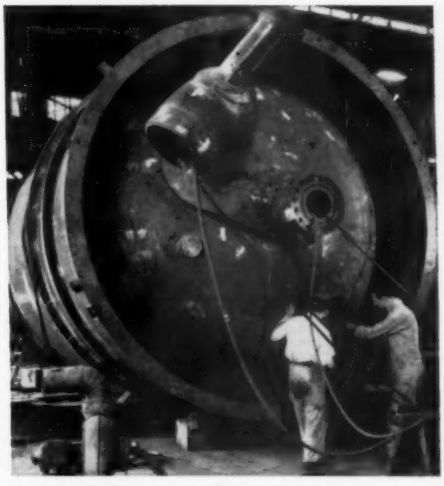
Welded with

ATOM·ARC 8016 CM

Welded by

Baldwin-Lima-Hamilton Corp.

Eddystone Division



Albert Imburgia, Welding Engineer, explains attachment welding detail on underside of reactor. Plate material is A301-54T-Gr. B firebox quality steel. Fittings are A 301-54T-Gr. B, A 335-53T-Gr. P12, A 182-53T-Gr. F12. Thicknesses ranged from 2-5/8" to 5-1/16".

100% X-ray sound with no rewelding is a common occurrence on Atom•Arc applications. It's also a common occurrence to find the country's leading fabricators switching to Atom•Arc electrodes for welding jobs involving mild and low alloy steels. One such company is the Baldwin-Lima-Hamilton Corp. of Eddystone, Penna.

Frank Iapalucci, Manager of Welding Engineering, and Carl Ascenzi, Chief Welding Engineer, have developed at Baldwin a quality control program for weldments that demands the ultimate in performance for every electrode used in their shops. Atom•Arc 8016 CM electrodes were their choice for all hand welds on this reactor for a large eastern refinery. The X-ray results proved their judgment sound.

Aside from the fact that no rewelding was required, the greater welding speed and easier operation of Atom•Arc electrodes were a great help in completing the job on schedule.

Atom•Arc electrodes will provide X-ray quality weld metal and greater joint efficiency, at a lower cost, on a wider range of ASTM steels than any other single group of electrodes. Atom•Arc electrodes are available in the following AWS grades: E7016, E7016 A-1, E8016 C-2, E8016 B-2, E9016 B-3, E10016 (1.70% Mn, .40% Mo), E12016 (1.9% Ni, .9% Mo, .2% V) and Atom•Arc T (E11016) for welding T 1 steel.

Find out how the savings and quality of Atom•Arc electrodes can benefit you. Contact your Alloy Rods Company distributor or write for informative data sheets.

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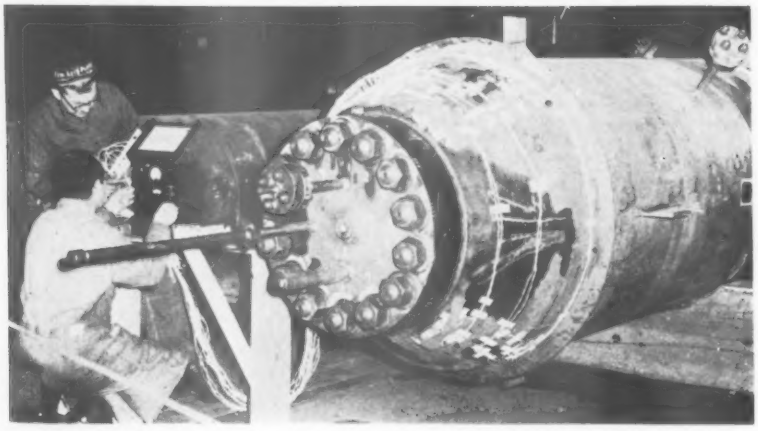
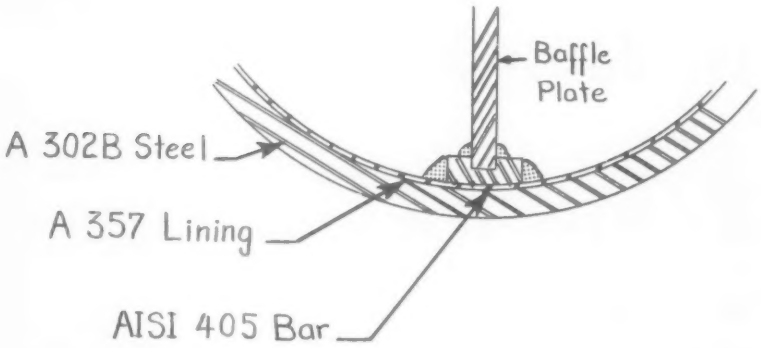
Welding 3 steels for a reactor vessel



HYDROSTATIC strain gage test at 7,500 psi indicates that this stainless steel-lined hydrogen reactor vessel will perform satisfactorily at design pressure of 5,000 psi. Manual arc welding was used on the vessel, with an electrode specially designed to weld the three dissimilar alloy combinations encountered.



THREE metal types involved in one joint of hydrogen reactor vessel at Foster Wheeler Corp.'s Mountaintop plant. Vessel has a 3-ft ID and is 30 ft long.

A LARGE pressure vessel fabricated by Foster Wheeler Corp., Mountaintop, Pa., involved the welding of no less than three dissimilar metals in a single joint. The manual arc process was used with an "Inco-Rod 'A'" electrode, a new type developed by International Nickel Co., Inc., for welding dissimilar alloy combinations.

Foster Wheeler regularly fabricates heavy weldments weighing up to 200 tons. The unusual 3-way problem occurred in a 30-ft-long pressure vessel with a 3-ft ID. The vessel was intended for use as a hydrogen reactor.

The shell was ASTM A302-B steel with a ⅜-in.-thick applied lining of A357 4-6% chromium steel. The vessel is divided longitudinally by a baffle located at the center line and extending the full length of the vessel.

Baffle Holders

Grooved bars holding the baffle in place were originally A357 4-6% chromium steel, the same material as the shell lining. These original bars were welded to liner and shell by means of a boom-mounted automatic submerged-arc welder using 4-6% chromium wire. Preheat of 400-500 F was applied.

"Zyglo" fluorescent particle tests revealed the presence of numerous cracks in the chromium steel weld. Repair efforts were unsuccessful and a new technique obviously was needed.

Two changes were decided upon in setting up the new procedure. First, a different material had to be selected for the grooved bars—one that would not develop so much hardness in the heat-affected zone. Accordingly, A-357 chromium steel bars were replaced by new grooved bars of AISI 405 alloy.

Second, since the new weldment involved joining the 302B steel shell, the 4-6% chromium steel lining and the 405 alloy grooved bars, selection of a suitable electrode to produce a sound weld was critical. Engineers at Foster Wheeler's Cartaret, N.J., welding laboratory recommended "Inco-Rod 'A'".

Since an extension boom carrying an automatic welding head could not be used in the new procedure, and the weldor had to enter the vessel, very little preheat could be applied. The application comprised two joint types.

Joint Types

First was a modified single-bevel at the base of the grooved bars which involved the three different base materials. Second was a double fillet weld, approximately ¼-in., joining the 4-6% chromium baffle and 405 stainless grooved bar into which the baffle is seated.

Four passes were made down the 30-ft length of the vessel, and welding required about one day. For the fillet weld, ⅛-in.-diameter electrodes were used; a 5/32-in. size was selected for the balance of welding.

Following welding, the entire vessel was stress relieved at 1200 F. Inspection revealed no weld cracks and the vessel was shipped. A recent in-service inspection reveals that the 3-in-1 welds are still as good as new.

Plant, Research Laboratories and World Headquarters

BETTER ORIGINAL FASTER
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STRONGER WELDS

EUTECTIC Welding News

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"EUTECTIC" WELDING HEADLINES • TIME-MONEY-MACHINERY SAVERS

MIDWEST AREA ACQUIRES EUTECTIC WAREHOUSE; Technical Information Center

A new warehouse to serve the fast growing Midwest has been opened in St. Louis by Eutectic Welding Alloys Corporation.

The warehouse will also serve as headquarters for Eutectic's Technical Information Service in the Midwest, North Central United States.

Welding users in the area are urged by Eutectic to take advantage of this new sales and service center, and avail themselves of the unique, free technical services offered by Eutectic Welding Alloys Corp.

In your own shop, factory-trained District Engineers will show you how to get every advantage of Eutectic's "Low Heat Input" metal joining methods. District Engineers (over 350 of them in the United States) have effected large savings for virtually every industry from coast to coast by suggesting welding applications which saved otherwise useless equipment, avoided lengthy downtime for repair and got rid of frequent breakdowns.

Eutectic's research labs and Technical Information Service are at your service to help you solve those "unsolvable" welding problems.

The new Eutectic warehouse will guarantee welding users in this area prompt delivery of the right rod for the job...a fresh-from-the-factory source for the more than 150 Low Temp EutecRods and Low Amp EutecTrodes manufactured by Eutectic.

Put this new Eutectic Warehouse-Service Center to work for you! To get better, faster, stronger welds and repairs call GEneva 6-4644, or write Eutectic Welding Alloys Corporation, 3719 Vest Avenue, St. Louis 7, Missouri. Do it today! ***(B-9)***

A BURNING QUESTION ONLY EUTECTIC COULD ANSWER

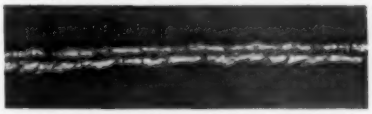
Overlays on the jaws of this "stripper" had to withstand temperatures up to 2600 F—often reached by the red-hot ingots it carries in a mid-western rolling mill. Repeated tests by the mill to find an alloys that would withstand these high temperatures resulted in failure. Conventional overlaying alloys were quickly burned off, and the frequent overlaying resulted in considerable expense, downtime and wasted labor. A Eutectic District Engineer was consulted. He recommended EutecBor #9, Eutectic's super-high alloy overlay, which has remarkable resistance to wear and corrosion at normal and elevated temperatures.

Overlays of EutecBor #9 were applied at 1800 F. Conventional overlaying materials require 2400 F. Low application temperature avoided dilution, and super-hard EutecBor #9 deposits were not mixed with softer base metal. Overlays of EutecBor #9 showed no trace of pitting or galling. In fact, as deposited it had an RC hardness of 55-62, and an RC 36-37 at 1600 F...or sufficient hardness to withstand jet aircraft exhausts.

The mill reported that EutecBor #9 overlays gave them six times greater wear than conventional overlays. ***(B-10)***

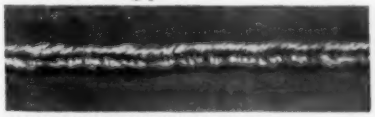
WELD FAILURES ARE COMMON WITH CONVENTIONAL HIGH HEAT WELDING ALLOYS

A conventional high heat welding alloys produced this weld. Bead was difficult to start. Deposit is porous, slag was difficult to remove. Wide amperage and voltage fluctuation occured, indicating poor weldability of electrode.



EUTECTIC PRODUCES BETTER WELDS AT LOWER TEMPERATURES AND AMPERAGES

EutecTrode 680 produced this weld. Bead is even and smooth. Deposit is dense and free from porosities and cracks. Superior arc control and action prove highest weldability. "Amp-heat Input" remained constant during pass.



YOU CAN SEE THE DIFFERENCE

Eutectic's patented, exclusive Low Heat Input® and Surface Alloying® metal joining processes make possible complete bonding between filler and base metals at temperatures far below fusion points of base metals. This avoids warping, distortion and stress invited by conventional high heat welding materials. ***(B-11)***

Eutectic Welding Alloys Corporation
40-40 172nd Street, Flushing 58, N.Y.

Gentlemen:

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Danny says:

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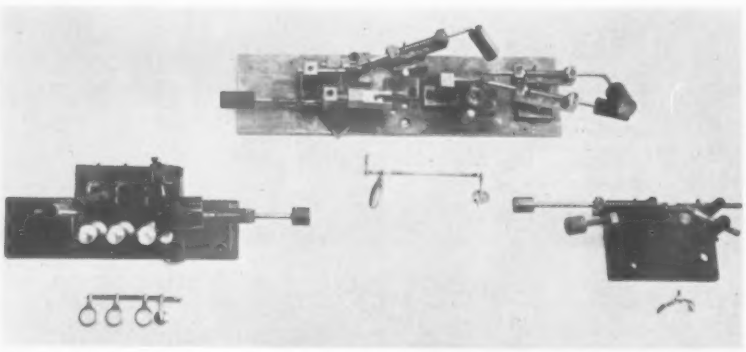


THREE of many jigs used by Selmer, with the parts they hold for soldering operations. Parts will not stick to carbide.

Carbide jigs make soldering a no-stick job

RESISTANCE to 1,600 F heat and oxidizing action of oxy-city gas flame is important factor in choice of carbide for jigs.

IN SILVER SOLDERING key assemblies for flutes and clarinets, H. & A. Selmer, Inc. of Elkhart, Ind., uses hundreds of different sets of cemented carbide jigs for locating and holding tiny parts.

Resistance of the cemented carbide to wear and deterioration, once it is coated with a thin oxide layer, is reportedly excellent even at soldering temperatures of 1,500 to 1,600 F.

Accuracy also is assured by this high degree of wear resistance. Neither solder nor the nickel-silver key components will stick to the carbide.

Stainless Once Used

Jigs developed by Selmer for its fine-detail work can handle from three to seven shapes. But before employing carbides—which are supplied by General Electric Co.—Selmer used stainless steel for jig elements.

Stainless was the best available material at the time it was used, but keys often were soldered to it. This unfortunate circumstance entailed filing—and the file sometimes had to be applied to jig elements as well as key components. Jig repair costs were naturally high.

Cemented carbide elements on most jigs consist of a visual guide bar, plus positioning and holding pins. Pins are sometimes fixed; sometimes they are placed on the ends of rods which are adjustable for proper positioning.

Typical Operation

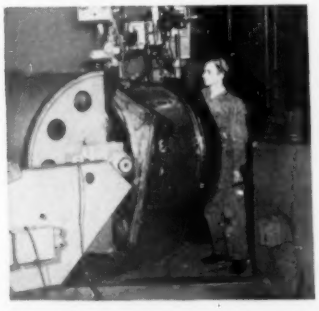
Illustrated above is a jig for assembling five key components in a typical soldering operation. Parts to be assembled are a small piece of wrought tubing, two nickel-silver castings, a pad cup of sheet metal and an adjusting lug.

The tube is positioned between the two end pins of the jig, which act as a bearing for the key. The tube is then a foundation for the castings, pad cup and the adjusting lug.

An operator can keep parts in correct alignment with the aid of the visual guide, and can position and hold parts with the adjustable pins. A flame combination of oxygen and city gas is applied to the fixtured parts, and 45% silver alloy soldering wire is used for all joints.

Worthington turning rolls handle a difficult welding job smoothly and easily in Foster Wheeler's Mountain Top, Pa., plant.

Why do 93 out of 100 leading industrial corporations use Worthington positioning equipment?



Worthington welding positioner in Foster Wheeler's Mountain Top, Pa., plant.

It's a fact. Of the 100 largest industrial corporations listed in the latest Fortune Magazine Directory, 93 are users. Progressive companies such as General Motors, General Electric and General Dynamics are long-time owners of precision positioners and turning rolls built by Worthington.

One reason why leading manufacturers have turned to Worthington is good service. With distributors in all principal cities, a Worthington specialist is always nearby to help solve your positioning problems.

Conservative ratings are another. Refusing to compromise with quality, Worthington engineers positioners to deliver, year after year, the rating stamped on the nameplate.

Pick your next positioner from Worthington's complete line. For helpful information on positioners, automatic welding head manipulators, turning rolls, head and tailstocks, write to Section Y-73, Worthington Corporation, Harrison, N. J. In Canada: Worthington, Ltd., Brantford, Ont.

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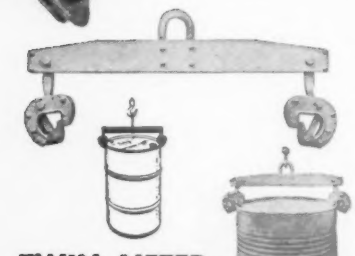

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AFTER chamber is welded, it is leak tested for joint soundness.

Tig shows way to space

SOMETIME this year an object will hurtle into outer space to orbit about the earth and to increase man's knowledge.

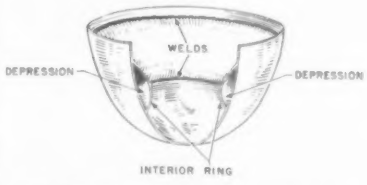
This is the earth's artificial satellite. Designed to gather geo-physical and solar information for scientists taking part in the International Geophysical Year, it is a blend of delicate instruments and rugged weldments.

The sphere, which weighs only 5½ lb and has a 20-in. diameter, will reach 1,400 miles into space at its farthest point. Without the aid of welding, however, planners might not have been able to create a satellite capable of leaving the earth.

Several Spheres Produced

Using Linde Co.'s Tig welding equipment, Brooks and Perkins, Inc., Detroit, Mich., has produced several of the spheres for the attempt to break through the ionosphere. The ionosphere, a sheet of electrically charged air, hovers between 50 and 250 miles from the earth's surface.

Magnesium sheet (96% magnesium, 3% aluminum, 1% zinc) is deep-drawn to form the upper and lower hemispheres of the satellite. The drawn sheets are turned on a lathe to give exact contour. An inner ring, also spun to shape, is Tig-welded to the 0.090-in.-thick magnesium sheets.



INTERIOR of lower hemisphere showing Tig-welded depression.

An air-tight pressure chamber is formed when the inner ring is welded into the lower hemisphere and registers variation in relative pressures and records size and speed of any space particles which may strike the satellite. Each hemisphere is then machined to reduce thickness from 0.090 in. to 0.050 in. at the top, and 0.030 in. at the bottom. This will give greater strength during launching.

An internal framework to carry electronic equipment is Tig-welded from magnesium tubing. To this internal framework four antenna-mounts are welded to act as structural pieces joining the framework to the shell.

Two other components are welded: an access door ring, providing an entry into the finished satellite for checking instruments, and an end ring for connecting the sphere to the launching rocket. Welds are stress-relieved to remove any dangerous stresses formed during welding.

Welding Specifications

All welds are made with the Tig process. A-c is used with high frequency and a current setting of about 100 amp for maximum joint strength and density. Filler rod is magnesium, fed at a rate of approximately 6 in. per minute. Flow rate for the argon shielding gas is 20 cu ft per hour.

When fabrication of the hemispheres has been completed, the halves are joined with watchmaker's screws—so minute that they do not project above the sphere surface.

The mirror-polished surface is plated with gold in an electromechanical process before delivery to the Naval Research Laboratory for additional coatings. Silicon monoxide, vaporized chromium, vaporized aluminum, and silicon monoxide are applied at the laboratory to complete sphere fabrication.

Weldors who are amateur sky-watchers may one day catch a glint of the satellite's metal skin as it rushes across the skies, and know that their art has helped man learn more about his world.

NEW!

Now equipped with a new and larger Onan 12.9 hp engine, the new Miller AEA-200-L produces a full 225 amperes of continuous rated, high cycle welding current or, 5 KW of 110/220 ac power for operation of power tools, lights, milking machines, etc., or, 1 KW of dc power.

Contractors, job weldors, farmers and many industries have shown a continuing high regard for the AEA's weatherproof ruggedness, easy portability and instant changeover versatility from ac welder to power plant to pipe thawer.

Readi-pull starter, rubber tire running gear and road trailer available as optional equipment.

Complete specifications sent on request.

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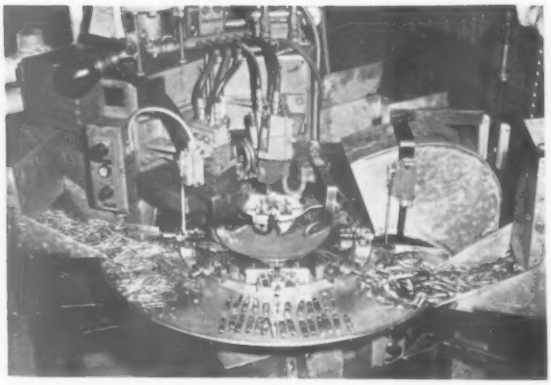


THIS resistance welder produces 11,000 "Shu-Lok" fasteners *(left)* each eight-hour shift. It is adjustable from 25-60 indexes per minute.

"Shu-Lok" closure: a shoe-in with welding

THE old fashioned shoe lace may be replaced in the near future by the "Shu-Lok" fastener, a development of Talon, Inc. Welding has greatly strengthened the device which utilizes an adjustable yoke to maintain a snug fit on the foot.

During field tests, engineers found that the hard wear teen-agers give shoes required a reinforcing wire on the plate. Precision Welder and Flexopress Corp., Cincinnati, Ohio, designed and built an automatic welder to perform this function.

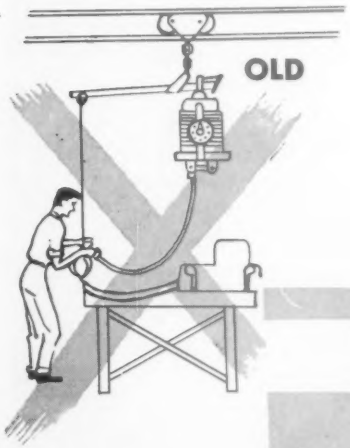
Two workers are required for the operation: one loads the plate and the other the reinforcing wire. The machine itself is adjustable from 25-60 indexes per minute. This allows greater speed as the worker gains greater experience.

The first major application of welded items fixed in shoes, the machine will produce 11,000 pieces each eight-hour shift.

SAVE 4 WAYS WITH

Suspended transformer type spot welders can waste as much as half the power between the separate transformer and the gun. In addition, the heavy connecting cables get in the way and slow the operator. The original cost of gun plus separate transformer is excessively high and, added to this, is the high cost of special wiring.

- No power loss. Transformer built-in
- Handy, maneuverable — no heavy, unwieldly cables
- Usually costs about half as much as gun-plus-transformer
- Works on existing power lines



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Manhattan Cut-Off Wheels are made to your order in the widest range of types and sizes. Manhattan Portable Wheels, Moldiscs, and Centerless Wheels are also custom-made for specific operations at your plant. Let a Manhattan Abrasive Wheel engineer show you how you can save time and money . . . get "More Use per Dollar" . . . with Manhattan Cut-Off Wheels and other types of high speed, heavy duty abrasive wheels.

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National-U.S. Radiator Corporation

New set-up speeds hardfacing for tractors

AN indexing fixture and an automatic submerged welder make it possible to hardface tractor rollers in a fraction of the time required by manual metal-arc techniques.

Making extensive use of automatic and semiautomatic machine components manufactured by Lincoln Electric Co., Russell Lay, the owner of a small machine shop in Mt. Vernon, Ill., developed the machine over a two-year period.

Power Steering

Welding head, flux hopper, the cabinet housing power supply, and wire feed mechanism travel horizontally. Powered by a motor-driven feed-screw, the welder may also be raised or lowered.

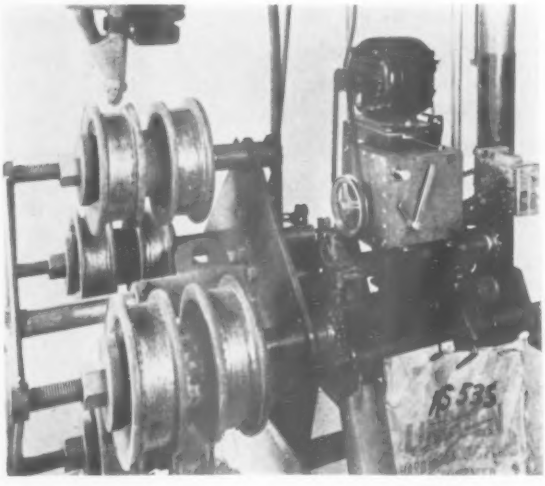
Rollers are fed slowly under the electrode by a chain drive connecting the central shaft with the four outer shafts. Travel speed under the arc—15 to 25 in. per minute—is controlled by a speed reducer. The welder is powered by a 600-amp motor generator; in the field it can be powered by a gasoline generator.

INVENTOR Lay adjusts controls of automatic hardfacing machine. Flux adds hardness qualities to mild steel wire used.

Wire and Flux

For electrode wire, 3/32-in. diameter mild steel is used. Flux is an agglomerated compound composed of carbon, ferro-alloys of chromium, manganese, silicon, and molybdenum. This flux adds desired impact and abrasion resistance to the deposited metal. Because fluxes are available in several standard analyses, variation in surface hardness can be attained.

An additional feature of the welder is that the indexing fixture may be removed to permit larger rollers to be hardfaced. In-the-field, on-the-spot hardfacing may be done in addition to work on such cylindrical parts as oil well tool joints.



WELDING head moves over a roller. Wire feeds from a spool onto the weld. The indexing fixture mounts four rollers, permitting faster hardfacing. Unit is removable for positioning of larger rollers.

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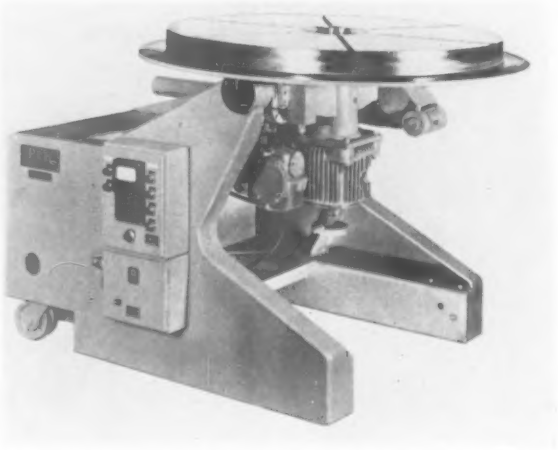
new products . . . . . USE CARD ON PAGE 117

USING a new hollow welding wire and a semi-automatic welding machine, a weldor hardfaces a heavy steel wearing surface. Welding wire is fed automatically through a 14-ft flexible shaft, giving unusual reach. (See story below.)



EXTENDED stationary table under the revolving face plate of this welding positioner will support inert gas dome or working enclosure. (See story below.)

Tubular electrodes

FLUX and hardfacing alloy are held compactly within the drawn steel tubes of new tubular electrodes. Offered are S/A manganese wire coils for manganese steel buildup and repair, and S/A 53 for hardfacing to resist both wear and impact.

Amsco S/A 53 can be laid down at 150 to 350 amp a-c or d-c, reverse polarity. It can be deposited at 5 to 15 lb per hour, on weldable carbon steels or manganese steel. Hardness ranges from 425 to 475 Brinell.

Amsco S/A manganese deposits austenite manganese steel (non-magnetic). It is designed for strength welding and buildup of cast and rolled manganese steel. Hardness is about 200 Brinell, but it can be work-hardened to 450 to 500. *American Manganese Steel Div.*

Circle No. 1

Flowmeters

DUAL-range flowmeters, the "1600" series, are designed for inert-gas welding, flushing molten metals and industrial applications where close control and constant check of flow rate is necessary.

Flow ranges are wide enough to meet gas demands which usually require more than one metering device. Rapid in-service switching from either flow range to the other is done with a piston-type selector valve. Flow rate within either range is controlled by a sensitive needle valve.

The series includes seven direct-reading flowmeters (each for a specific gas) and one general-purpose flowmeter provided with calibration curves which will meter any of five gases. A combination of flowmeters can proportion a mixture of gases.

The new meters can be attached to cylinder or pipeline regulators, directly to pipelines or they can be bench or wall-mounted with a special mounting clamp which is supplied. *Air Reduction Sales Co.*

Circle No. 2

Aluminum alloy

FILLING the need for high strength, easily welded plate for marine and structural uses is new alloy 5456. It can be joined by resistance, Tig and Mig welding. Suited for such heavy duty structures as overhead traveling cranes, ship unloaders. The plate ranges in thickness from 0.250 to 2.0 in. Tensile strength of welds exceeds 42,000 psi minimum. *Aluminum Co. of America*

Circle No. 3

Safety clothes

HARMFUL ultra-violet rays are guarded against in a new line of safety clothing called "Black Beauty." Tanned split cowhide leather in a dull black color withstands the ultra violet rays.

Garments include cape sleeves, jackets, bib aprons, leg aprons and sleeves. *Singer Glove Mfg. Co.*

Circle No. 4

Welding positioner

PRECISION welding requirements of aircraft and guided missile fabricators are met in a new welding positioner, Model WP-2-S. It features an extended stationary table under the revolving face plate which will support an inert gas dome or working enclosure. Table speeds of 0.02 to 2.0 rpm are reached through an electronic d-c motor.

Available as stationary machine or with casters. A rotating ground connection at the end of the table spindle insures adequate current capacity for automatic welding applications. *Harnischfeger Corp.*

Circle No. 5

Vacuum package

RETORT unit for processing small parts in a vacuum or protective atmosphere is self-contained, complete package unit. Processing is done in a vacuum retort satisfactory for temperatures up to 2,000 F, at a vacuum of 0.5 micron or better. Work is heat treated and cooled in the same tube.

Package includes a furnace, automatic controller, pyrometer, 3-in. ID tube with water-jacketed cooling chamber, track and accessories for inserting tube into heat zone, 7-in. work boat, mechanical vacuum pump, diffusion pump and vacuum gage—all mounted on a steel work table. *Lindberg Engineering Co.*

Circle No. 6

Installation of NEMA type N2X Robotron 361C Resistance Welding Controls at International Harvester Plant, Chatham, Ontario. Equipped with 200 amp., 2-pole 600 volt isolation switch, and special Safety-Lock doors.

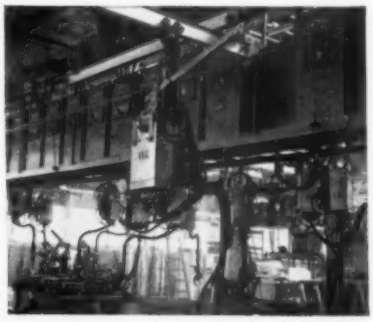
Production welding operations are big factor in International Harvester quality control

Canadian Plant Uses Robotron Timers on Resistance Welders

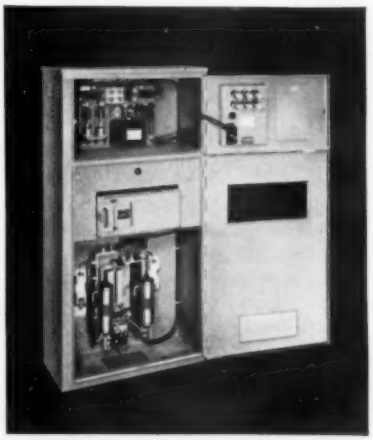
Modern production equipment is one of the important reasons behind International Harvester's world famous reputation for quality products. At IH's Chatham, Ontario plant, Robotron resistance welding controls are playing an important part in maintaining this high level of quality in IH trucks for the Canadian market. Robotron precision timers provide efficient, economical control for the scores of resistance welders at work on the company's production line.

Varied resistance welding problems can be solved with one master unit through interchangeable "plug-in" type components . . . holding costly downtime to a minimum, eliminating equipment tie-ups and reducing obsolescence. The design simplicity of Robotron controls allows maximum on-the-job versatility.

To improve product quality and reduce production costs in *your* operations, let Robotron's experienced staff team up with you in the practical solution of control problems. Discuss your requirements with a Robotron field representative.



Another view of installation showing close-up of welding transformers and portable guns.



Series 361C Resistance Welding Control, consisting of Model 3B08E-C NEMA 3B "Fail-safe" tube firing timer, isolation switch, and 600 amp. ignitron contactor.

THE FINEST IN INDUSTRIAL ELECTRONICS

Robotron CORPORATION

21300 WEST EIGHT MILE, DETROIT 19, MICHIGAN

INDUSTRIAL ELECTRONICS FOR YOU...FROM ROBOTRON —A new bulletin available on request. Write for your copy today.

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REPRESENTATIVES IN PRINCIPAL CITIES IN U. S. AND CANADA

Meet the Complete

LIQUIDWELD

Family . . .

Now, Liquid Presents A Full, Dynamic Line of *Liquidweld* Gas Welding and Cutting Equipment!

You've seen and heard about the new, functional Liquidweld Regulators . . . Now see the rest of the family . . . torches, cutting tips, nozzles, etc. Here's everything to make good welders even better . . . with the highest quality equipment available to the industry.

Liquidweld . . . precision-machined from bar stock . . . designed to make your welding and cutting safer, with superior results, and a minimum of operator fatigue.

The new Liquidweld line is available in single units, or for greatest efficiency, in complete outfits.

Liquidweld

Complete illustrated literature is now available. **WRITE TODAY.**

THE LIQUID CARBONIC CORPORATION

3100 South Kedzie Avenue, Chicago 23, Illinois

District Offices and Dealers in Principal Cities—In Canada: IMPERIAL OXYGEN LIMITED, Montreal

Disc, wheel support

CUSHION-type rubber support for the depressed center resinoid discs and wheels are 3 in. in diameter. This disc support, which absorbs and deadens vibration, replaces the former metal adapter. The support smooths out vibration caused by misaligned or off-balanced discs, and the cushioning action of rubber prolongs the life of the grinder. *The Nedco Co.*

Circle No. 7

Hot solder

BECAUSE this hot solder (95% zinc, 5% aluminum) melts at 715 to 725 F, it can make high temperature joints. The solder and flux can join all aluminum alloys and make joints between aluminum and other metals (copper, brass, steel, nickel, etc.) *Aluminum Co. of America*

Circle No. 8

Vertical welder

SPOT welding machine for bench and pedestal mounting does vertical welding. It has a ground vertical shaft No. 2 which moves up and down in ball bushings.

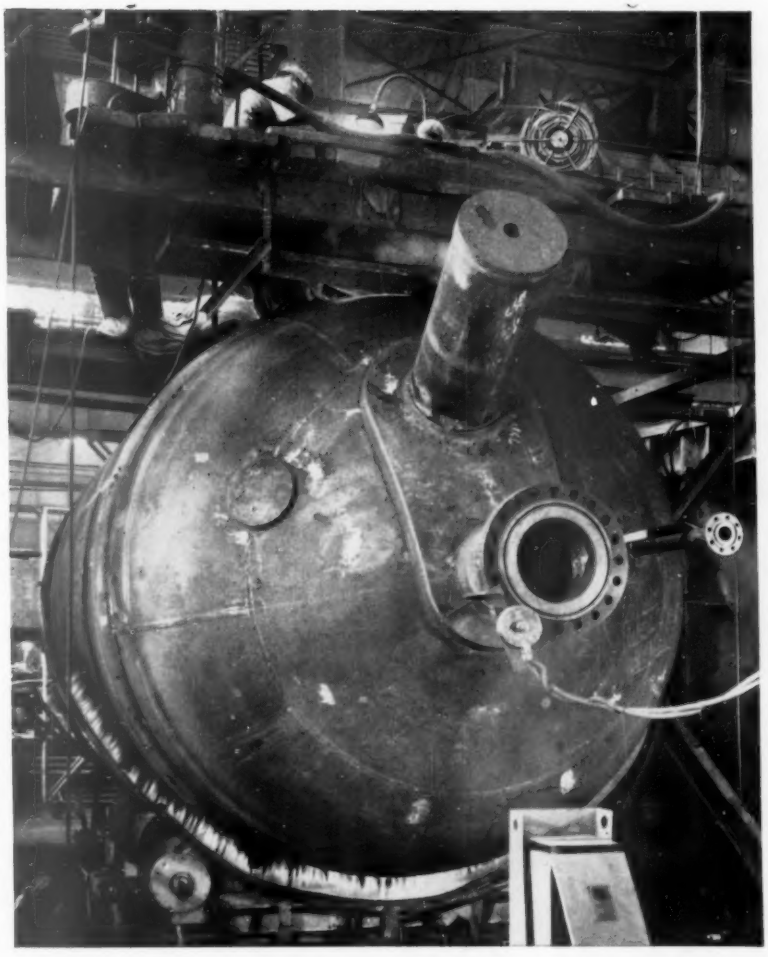
Welders come in sizes from ½ kva to 5 kva and include timing devices and transformers. They are usually foot-operated. *Eisler Engineering Co.*

Circle No. 9

Plastic steel

A steel-like plastic is available to repair machinery, make tools, jigs, molds, and for general maintenance. Applied like putty, it hardens without shrinkage within two hours. It can be carried indefinitely without deteriorating and can be drilled, tapped, sawed or ground. Called "Devcon," it will bond itself to iron, steel, glass, bronze, aluminum, wood, brass, plastics and other surfaces. *Devcon Corp.*

Circle No. 10



When fabrication codes demand 100% X-ray inspection...

SPECIFY *Drawalloy* CORPORATION

Stainless Steel Welding Wire

In hundreds of applications, *Drawalloy* wire has been put to the test . . . X-ray, dye check, pressure and service and with the same consistent result—OK as welded. That's why Frank Iapalucci, Manager of Welding Engineering for Baldwin Lima Hamilton, Eddystone, Penna., selected *Drawalloy* chrome-moly wire for the automatic welds on this reactor. The vessel is constructed of A 301-54T Grade B firebox quality steel ranging in thickness from 5-1/16" to 2-5/8". *Drawalloy* 1-1/4 Cr, 1/2 Mo wire was used for all submerged arc joints.

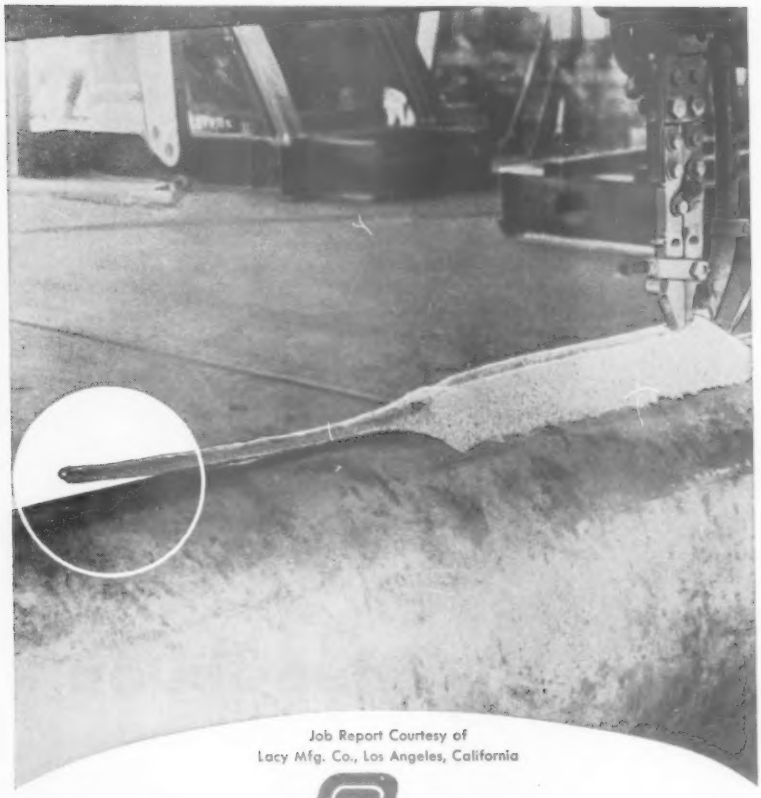
When inspection by X-ray is required, don't gamble . . . rewelding is expensive . . . specify Drawalloy "quality controlled" wire. *Drawalloy* stainless steel welding wire is produced to strictly controlled specifications to provide the right chemistry, finish and temper for smooth operation in your equipment and to provide X-ray quality welds.

Why not discuss your stainless welding wire needs with your *Drawalloy* Distributor or Representative . . . a man ready to help you. Bulletin 355-DC provides complete information on every grade of *Drawalloy* wire. Write to: Drawalloy Corporation, Lincoln Highway West at Alloy Street, York 12, Pennsylvania.

DRAWALLOY
CORPORATION
YORK, PENNSYLVANIA

THE WIRE MILL FOR THE WELDING INDUSTRY — STAINLESS STEEL · HARD SURFACING · TOOL STEEL

Now, submerged arc stainless welds with slag that "pops-off"



Job Report Courtesy of
Lacy Mfg. Co., Los Angeles, California

WELD WITH ARCOS

Stainless Wire and Arcosite Flux

Arcos research and experience with stainless weld metal now pays you *another dividend*—for the first time . . . consistently *self removing slag!* On the job above, submerged arc welding of a section of pipe for petroleum equipment, two passes were made with 1/8" coiled CHROMENAR KMo Stainless Wire and ARCOSITE S-4 Flux. As the photo shows, the cooling slag is lifting free by itself . . . leaving a clean, smooth bead. Think what this can mean to you on your own submerged arc welding jobs . . . saving time and money . . . better welds than ever before. ARCOS CORPORATION, 1500 S. 50th St., Philadelphia 43, Pa.

Tig welder

DESIGNED to meet welding requirements in jet engine fabrication and to weld hard-to-weld alloys, the new "Weltronarc" Tig welder automatically controls precision fusion welding. This new control welds titanium, high temperature stainless steel, etc.

In one unit is the arc power supply with up-and-down slope to eliminate burn-through and craters, an automatic arc-length control, a closely regulated wire drive and carriage drive, gas and water controls and the timer sequence. *Weltronic Co.*

Circle No. 11

Torch lighter

"TORCHIE" torch lighter is about 3 in. high and 3 in. wide, and plugs into any 110-volt outlet. It has a special low voltage transformer (2½ volts at 7 watts). Lights by flicking the torch over the lighter top. $9.95 each. *Thermacote, Inc.*

Circle No. 12

Silicon rectifiers

Two new hermetically sealed silicon power rectifying cells (types 302 and 303) provide d-c currents up to 35 amp. and 22 amp. halfwave, respectively, with a maximum peak inverse voltage up to 600 volts.

Forward voltage drop of cell 302 will not exceed 0.9 volts at a forward current of 10 amp. in ambient temperatures of 25 to 35 C. Maximum operating junction temperature is 190 C.

For cell 303, forward voltage drop will not exceed 1.2 volts at a forward current of 10 amp. in ambient temperature of 25 to 35 C. Reverse leakage is a maximum 10 milliamperes at rated peak inverse volts and maximum temperature. Maximum operating junction temperature is 190 C.

Each cell weighs 0.65 oz., is shipped with hex nut, lock washer and flat washer, two 0.003-in. thick mica washers and an insulating bushing. *Westinghouse Electric Corp.*

Circle No. 13

Powder blower

SELF-contained, portable unit for magnetic particle testing is available to apply dry "Magnaflux" powder. The blower operates directly from any air line and requires only 20 psi, manufacturer states. A simple adjustment controls density of the cloud of powder; two push buttons permit selection of either powder or clean air. When the gun is level and at a distance from the area tested, particles flood the area to show when cracks are present. Blower weighs 2¼ lb. *Magnaflux Corp.*

Circle No. 14

Brazing alloys

SPECIAL vacuum-tube grade silver and gold brazing alloys are now available in production quantities. The alloys are designed specifically for brazing electronic components in which concentrations of metallic impurities must be kept to a minimum. Alloys are carbon-free and meet all applicable industry specifications on maximum content of cadmium, zinc and other volatile elements not allowable for vacuum-tube work. They are supplied in wire, strip and sheet form in all usual gages. *Handy and Harman.*

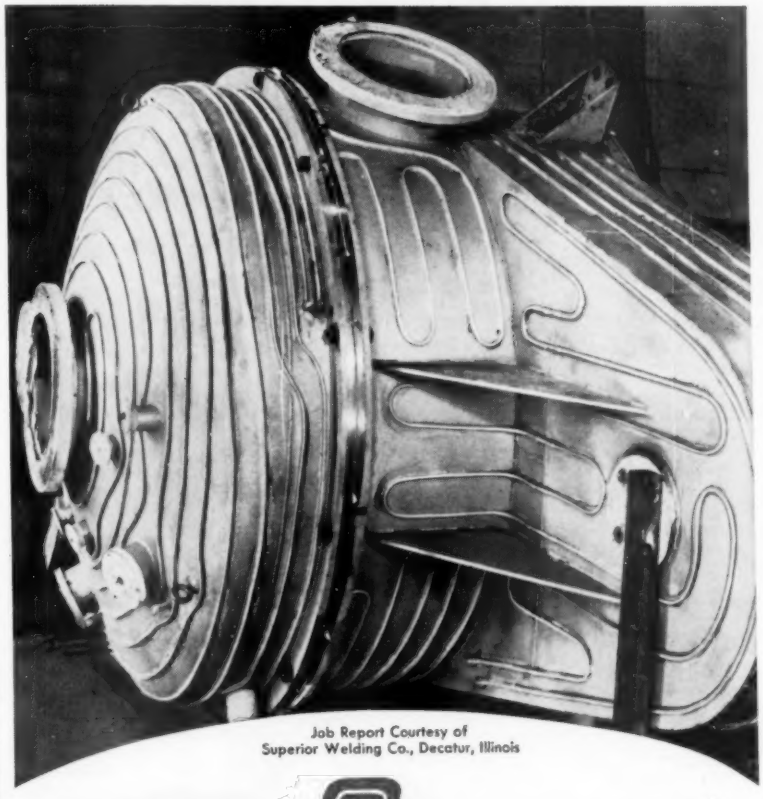
Circle No. 15

Lens cleaner

COMBINATION lens cleaner and antifog fluid keeps both plastic and glass surfaces fog-free. Lenses remain defogged under extreme conditions, but cleaner is non-toxic, non-flammable and will not deteriorate metal or rubber. *American Optical Co.*

Circle No. 16

When stainless welds must be VACUUM TIGHT

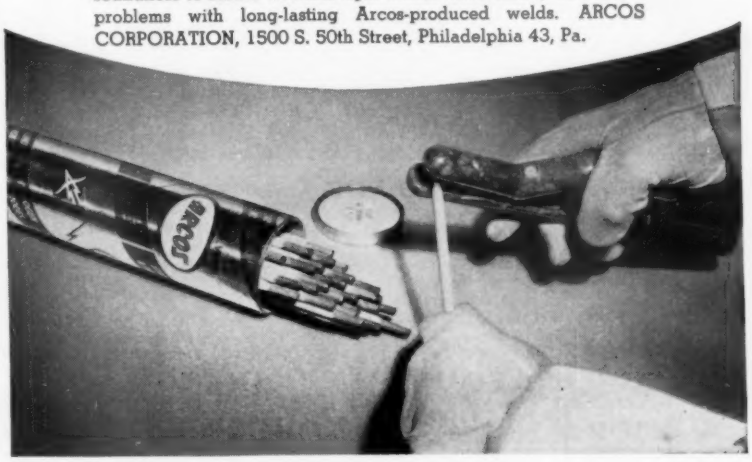


Job Report Courtesy of
Superior Welding Co., Decatur, Illinois

WELD WITH ARCOS

STAINLESS ELECTRODES

Shown here is a stainless steel furnace body of type 304 ELC for use under very high vacuum conditions in the casting of metals where exceptional purity is required. Arcos Chromend K-LC Stainless Electrodes were used because Arcos electrodes not only assured the proper weld metal chemistry, but also the necessary soundness to insure vacuum tight welds. Save money and future problems with long-lasting Arcos-produced welds. ARCOS CORPORATION, 1500 S. 50th Street, Philadelphia 43, Pa.



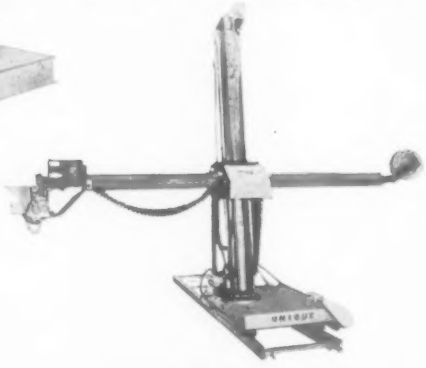
IF YOU NEED THIS EQUIPMENT . . . YOU HAVE ALREADY PAID FOR IT!

PRECISION WELDING POSITIONERS

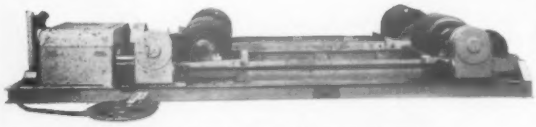
Model UPC-Series

Featuring: **NO BACKLASH** when new or old. Adjustable pinions eliminate this condition.

Capacities: From 500 lbs. to 60,000 lbs.



PRECISION WELDING HEAD MANIPULATORS



Model UM-Series

Featuring: Boom leveling & Track lateral adjustments.

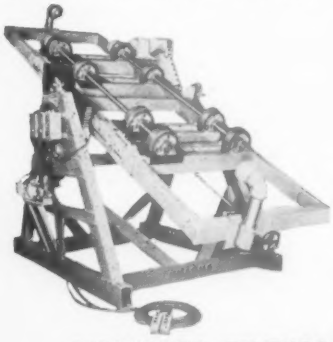
Capacities: From 6 ft. to 12 ft. on Booms. From 6 ft. to 14 ft. on Masts. Larger sizes available.

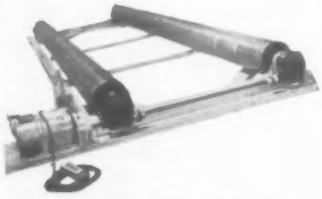
POWERED PORTABLE TURNING ROLLS & FRAME-BASE ROLLS

Model UTP-Series

Featuring: Perfect smooth rotation.

Capacities: From 2,000 lbs. to 500,000 lbs.





POWERED & IDLER FIT-UP ROLLS

Model UFR-Series

Featuring: 20 ft. length adjustable rollers for perfect tack-up or finished "butt" alignment.

Capacities: From 10,000 lbs. and up.

POWERED TILTING ROLLS

Model UTRP-Series

Featuring: Tilting to 35 degrees in either direction.
Easy pull-cuts for variable lengths.
Thrust balls for closed end vessels.
Radial bearings for open end vessels.

Capacities: From 5,000 lbs. to 20,000 lbs.

UNIQUE EQUIPMENT, INC.

122 Sumpter St. Brooklyn 33, N. Y.

Steel alloy

FLUX-cored version of a high-strength, silver-bearing, lead-free alloy for stainless steel and other base metals is in coil form. The new solder-type alloy is "EutecRod 157B."

It can be applied in all types of joints in stainless steel fabrication and for dissimilar metal joining, especially copper, brass and bronze. Alloy has a low application temperature range of 400 to 500 F. The lead-free deposits do not blacken.

Available in 1/8, 1/16 and 3/64 in. diameters and is adaptable to all common heating methods, including flameless resistance, induction and transformer type soldering gun techniques. *Eutectic Welding Alloys Corp.*

Circle No. 17

Portable tester

HYDRAULICALLY operated machine for quick compression testing combines hand pump operation with vertical adjusting and a capacity of 150,000 lb.

Overall weight of model TP-121 is about 170 lb. The unit can be handled by two men. Handles and a folding hand pump make the unit portable.

By removing eight screws the upper head can change position and any vertical dimension between 9½ in. and 32 in. can be obtained. Width between uprights is 11 in. Overall height is 46 in., width 20 in., depth 30 in. *Steel City Testing Machines, Inc.*

Circle No. 18

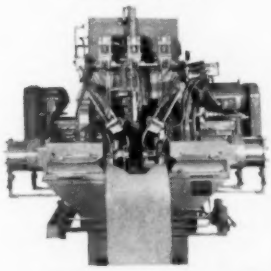
X-ray tube

END-grounded, forced-air cooled X-ray tube provides high-power continuous loading. The Eg-180R requires neither hose lines nor heat exchangers. Full power may be used at ambients as high as 135 F. The tube needs two minutes or less for morning warm-up, then individual exposures require less than half a minute.

Available in two versions, the tube comes in a beryllium window tube with a 40 deg cone of radiation, and in a nickel window tube with a 360 deg band of radiation. *Machlett Laboratories, Inc.*

Circle No. 19

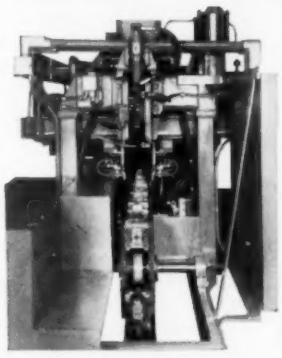
Entry end of line



Federal

PACKAGED PRODUCTION LINE

Automates Pedal Bracket Manufacture for Dodge!



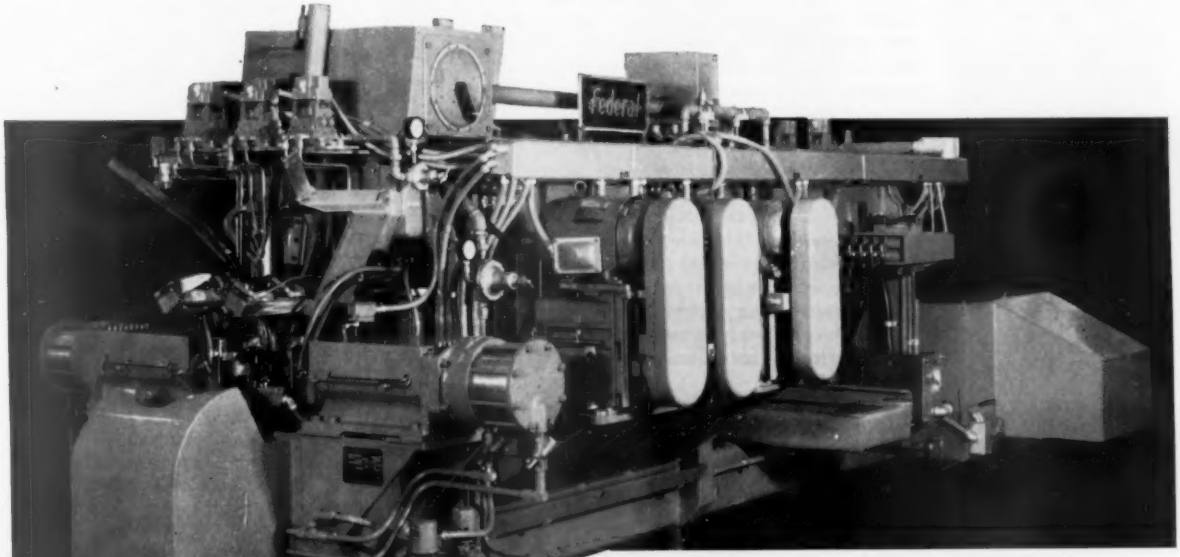
Exit end of line

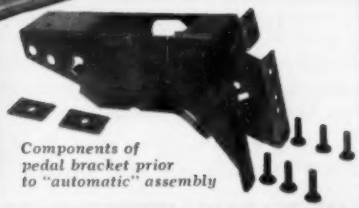
SINGLE LINE AUTOMATICALLY FEEDS, SPOT FACES, REAMS, DE-BURRS, WELDS TO SPEED PRODUCTION, CONTROL UNIFORMITY OF PEDAL PART

The Dodge Division of the Chrysler Corporation recently set into operation a single Federal machine that performs manufacturing functions normally requiring many separate pieces of equipment. In the fabrication of automotive pedal brackets this Federal "Packaged Production Line" was made to feed and weld two pads to the bracket, spot face one pad, ream and de-burr holes in each pad, feed and weld six mounting bolts and eject the finished piece at a rate of 775 units per hour.

The combining of several manufacturing operations into one has many natural advantages. It means one source responsibility, reduced floor space, and handling requirements, equipment economies and greater product uniformity.

Don't overlook these benefits—talk with Federal—a pioneer in the development and manufacture of "Packaged Production Lines."





Components of pedal bracket prior to "automatic" assembly

Finished pedal bracket

Federal® WELDERS

Warco® PRESSES

The Federal Machine and Welder Company

225

WARREN, OHIO

Ranite hardsurfacing lays down faster... lasts longer on all construction equipment!

Periodical Ranite hardsurfacing of crusher rolls, mill hammers . . . scraper blades, and all areas that wear out fast insures *longer equipment life . . . saves replacement costs . . . cuts down time.*

Ranite's fast deposition rate and greater metal recovery means that wearing surfaces are built up faster with less hardsurfacing material, in less down time.

You can depend on Ranite's speed . . . Ranite's economy because they are formula-controlled. Pure powdered alloys and the exact amount of flux necessary for instantaneous fusion have been combined for a perfect, balanced formula. This permits 80 per cent metal recovery during hardsurfacing for maximum metal recovery per pound.

Ranite's balanced formula makes possible a deposition rate 20 to 25 per cent faster. It's smoother, too, right down to the butt end. With easy-to-use Ranite, welders can lay down more metal per hour uniformly in any position. It will not chip . . . spall . . . mushroom.

There's a Ranite Hardsurfacing Welding Rod for every type application—from Rockwell C hardness 25 to 68. Send now for free Comparison Chart and complete information on Ranite. Field engineers are also available for consultation on any hardsurfacing problem.

Ranite HARDSURFACING WELDING MATERIALS

ASK YOUR DISTRIBUTOR FOR RANITE!

RANKIN MANUFACTURING CO.

616 S. Marengo Ave., Alhambra, California

Arc welding

SEMIAUTOMATIC submerged-arc welding unit is compact and lightweight. Unit is equipped with control power cable for use on 110 volts; a-c/d-c wire reel; caster-mounted base and carrying handles. Gun cable assembly is included with two interchangeable guns—one flux-type with hopper and one open-arc for welding without flux.

Wire-feed speed control rheostat and associated components are housed in steel cabinets which may be used as single unit or separated for remote control. Each has individual carrying handle. Unit is designed for any arc welding with continuous current to 500 amp, using solid wires (5/64 or 3/32 in.) and tubular wires (3/32 or 7/64 in.) with either type of gun. *Hobart Bros. Co.*

Circle No. 20

Torch filter

FOR liquid or gaseous fuels, a new torch filter is equally effective when used with welding, brazing or cutting torches, manufacturer claims. Special "Permetal" no-flash design prevents particles as small as 0.001 in. from entering the torch, and helps prevent flashback from passing through the filter to the hose lines.

Filter is composed of outer one-piece body and inner one-piece core made of bronze. Takes about one minute to install. *Gibbs Ltd.*

Circle No. 21

Face Shield

NEW method of heat forming face shield windows gives permanent curvature to fit the inside radius of the spark deflector, manufacturer says. Pressure on fasteners is reduced, decreasing wear and tear. Windows are slotted to allow fasteners to float, permits easier attachment and in extreme heat the window does not become distorted. Spark deflector and window are set forward, giving an extra inch of clearance so spectacles can be worn comfortably. *American Optical Co.*

Circle No. 22

Welder

LADDER welder, operated by one man, can weld ten 3-rung ladders per minute. Reportedly saves 30 operations since it is no longer necessary to use nuts, bolts, rivets, arc welding or punching. Ladder welders are made in single-phase, two-phase and three-phase. Only 635 amps are required to make any size rung ladder, from 1 to 50. *Ames Spot Welder Co., Inc.*

Circle No. 23

Automatic Aircomatic® welding of longitudinal seam with CO_2.

CO_2...low cost gas shield for metal arc welding

Carbon dioxide is fast gaining acceptance as a most economical shielding medium among fabricators of arc welded mild steel. It's ideal for single or multi-pass applications . . . *manually* or *automatically*.

Pureco Technical Sales Service can give you all the information you need about CO_2 in welding. Call your Pureco representative today! There are more than 100 locations from coast to coast for your convenience.

AT THE FRONTIERS OF PROGRESS YOU'LL FIND . . .

AN AIR REDUCTION PRODUCT

PURECO CO_2

Pure Carbonic Company

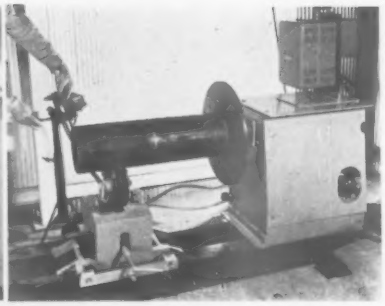
NATIONWIDE "DRY-ICE" SERVICE-DISTRIBUTING STATIONS IN PRINCIPAL CITIES

GENERAL OFFICES: 150 EAST 42ND STREET, NEW YORK 17, N. Y.

PURE CARBONIC COMPANY is a division of **AIR REDUCTION COMPANY, INCORPORATED** • Principal products of other divisions include: **AIRCO** — industrial gases, welding and cutting equipment and acetylenic chemicals • **OHIO** — medical gases and hospital equipment • **NATIONAL CARBIDE** — pipeline acetylene and calcium carbide • **COLTON** — polyvinyl acetates, alcohols and other synthetic resins.

. . . Aligning Pipe to Fitting

. . . Cutting Pipe



Save Time, Materials, and Money with a

PORTER PIPE MACHINE

The most versatile pipe machine of the welding era

. . . Salvage Fittings

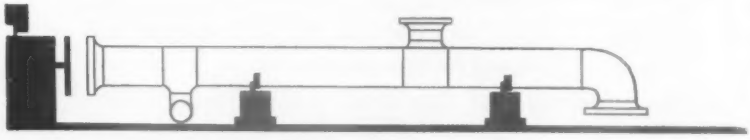
A new method of centering and holding* Remote control with a wide range of speeds. Handles 1½"—12" diameter pipe and fittings . . . lengths from 3" to 25 feet.

- **CUTS PIPE STRAIGHT OR BEVEL**
  Accurate cuts for ideal joint preparation means minimum amount of weld metal needed . . . means less welding per joint.
- **ALIGNS PIPE TO FITTINGS**
  Mechanically adjustable turning rolls give accurate control for quick alignment.
- **ROLLS PIPE FOR WELDING**
  Combination power-driven and free-wheeling rolls turns a wide variety of weldments with a swing clearance of 28 inches.
- **SALVAGES FITTINGS AND PIPE**
  Flanges, elbows and tees cut with proper bevels for re-use.

. . . Positioning

* Patents pending

- Perfect partner for **SUBMERGED ARC, INERT ARC** and **METAL ARC** Welding. Rolls long weldments with out-of-side branch lines and fittings.



R. C. PORTER COMPANY

Write for further information

9354 FLORAL AVENUE CINCINNATI 42, OHIO

Induction heaters

LINE of electronic induction heaters can be tailored to a specific heating application. Can include: built-in high frequency output transformer, stepless power control, dust-proof cabinet. Furnished with either single or two-position output. Available in three ratings—15 kw, 30 kw and 40 kw. *Magnethermic Corp.*

Circle No. 24

Hardfacing alloys

SAID to be the first low heat input hardfacing alloys depositing tungsten carbides on steel, cast iron or copper alloys with fusion are "Dril-Tec 86, 88 and 89." All three are composite, heterogeneous, preformed hard overlaying materials for providing cutting and wear and abrasion surfaces on equipment used for drilling, boring, reaming, etc. *Eutectic Welding Alloys Corp.*

Circle No. 25

Calibrator

DESIGNED for quick determination of the activity content of liquid or solid sources of radioactive isotopes, a new source calibrator has an overall accuracy of 5%. It is useful as a general purpose, semi-portable, wide range gamma radiation meter.

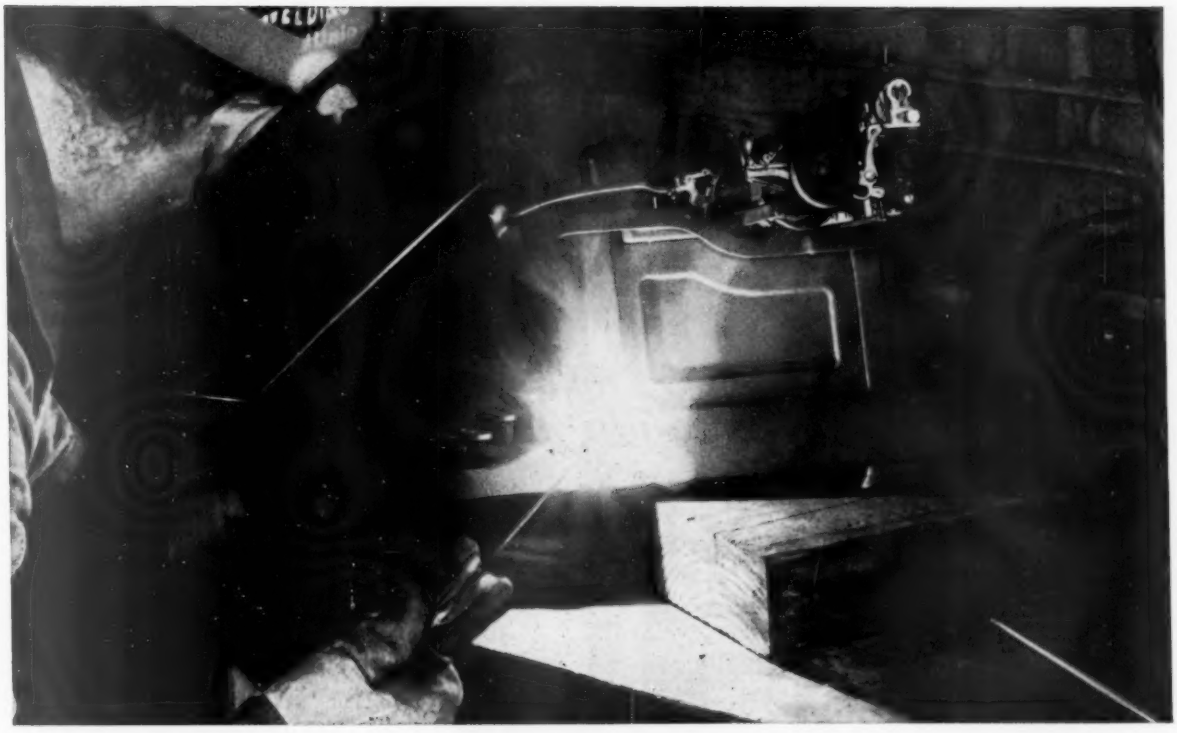
Activities ranging from 5 microcuries to 500 millicuries can be measured in one of the two well-type ionization chambers supplied with the unit. *Tracerlab, Inc.*

Circle No. 26

Polishing cloth

SILICONE cleaning and polishing cloths are non-woven rayon and treated to give a protective, odorless, non-oily, non-greasy coating to highly finished glass, plastic and metals. Cloth gives water-repellent finish. Good for lenses, precision gages and tools. Sample package is $1. *Edmund Scientific Co.*

Circle No. 27



Shop gets 50 to 100 extra welding jobs per month!

Ni-Rod makes broken typewriter frame castings good as new

Not long ago, weldors at the F. G. Welding Works, Inc., of Chicago, tried something new – welding broken cast iron typewriter frames with Ni-Rod* electrode.

Today, they're welding some 50 to 100 frames every month–a healthy portion of extra, profitable business!

Ni-Rod electrode was the ideal choice for welding the cast iron frames because of its quick and easy deposition. The fast metal arc process confines heat to the area being welded, and the weld is completed before heat can spread to a large area and cause stress distortions.

Excellent machinability of the welds is another reason repair with Ni-Rod electrode is so satisfactory. Welds are finished easily. Paint up perfectly. Frames look as good as new . . . and are!

There are a host of other cast iron welding jobs you can do successfully – and profitably – with Ni-Rod electrode. Many of them are discussed in *A Handy Guide to Welding Cast Irons.* This useful illustrated handbook gives tips on preparation, welding techniques, increasing machinability, welding heavy sections and stress relief–to name a few subjects covered. If you'd like a copy of this guide book, just write Inco.

*Registered trademark

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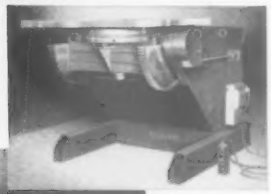
INCO WELDING PRODUCTS

Electrodes • Wires • Fluxes

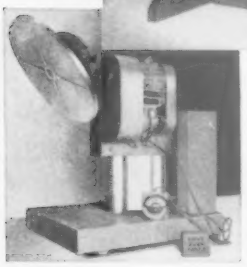
Aronson
Offers You Over 200 PROVEN Standard Stock Models of Quality POSITIONERS "POSITIONEERED" to your exact Requirements

Patented

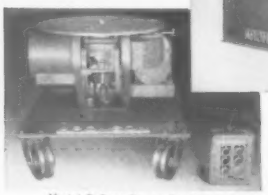
Aronson TracTred (T. M. Reg.) Turning Rolls for thin-walled heavy cylindrical work to 27 tons capacity. Zero to 100 IPM turning speed and Built-In Grounding.



Heavy Duty Precision Built Rubber and Steel Tired Turning and Pipe Rolls, 100% overload protected. Capacities to 300 Tons.


Fully Automatic Gear Driven Positioners, featuring Power Elevation, Tilting and Rotation. Capacities to 120,000 lbs.

Heavy Duty Gear Driven Positioners, with Magnetic Braking, Mercury Grounding, and Optional Speeds. Capacities to 120,000 lbs.


Heavy Duty Floor Turntables with precision speed control and Magnetic Braking, used for welding, burning, X-raying, etc. Capacities to 120,000 lbs., various heights and speeds.

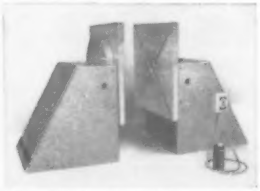
Model D Gear Driven Positioners. Compact. Precise. Rugged. Capacities to 1000 lbs.

Bench Turntable Automatic Positioners with Mercury Grounding Capacities to 500 lbs.

Aronson Twinner Permanent Magnetic Clamps, six models with thousands of uses in welding set-up work. Write for bulletin.

Patented

Aronson Universal Balance Positioners (T. M. Reg.) position your weldments effectively, instantly for downhand welding. Capacities to 2000 lbs.


Rugged Head and Tail Stock for positioning bulky weldments between centers. Table Backup for Zero Deflection, Magnetic Braking. Capacities to 160,000 lbs.

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UNIVERSAL BALANCE® POSITIONERS
BENCH TURNTABLE POSITIONERS
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RUBBER-TIRED TURNING ROLLS
RAIL CAR POSITIONERS • TURNTABLES
FULLY AUTOMATIC POSITIONERS
MAGNETIC WELDING CLAMPS

ARONSON offers you over 200 PROVEN Standard Stock Models of Quality POSITIONERS "POSITIONEERED" to your exact requirements

Write for detailed engineering data

Quality POSITIONERS by Aronson MACHINE COMPANY
ARCADE, NEW YORK

Electrode

HEAT treatable all-position electrode has been formulated specifically for fabrication of chrome-moly steel and other high tensile alloy steels, manufacturer says. Designed mainly for low alloyed steels, particularly the 4130, 4140 and 8630 grades. Deposits have heat treating characteristic similar to base metal.

Electrode exhibits deposited tensile strength to 100,000 psi, and deposits are fully heat treatable.

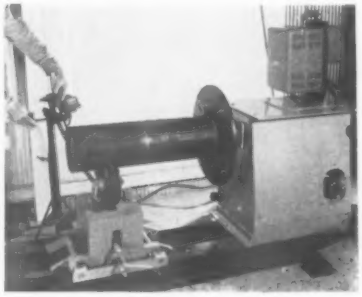
Specific end uses include fabrication of tanks, containers and vessels for high pressure work. Can be used with reverse or straight polarity on dc. Electrode is adaptable to overhead and vertical down welding. Available in 3/32, 1/8 and 5/32-in. sizes. *Eutectic Welding Corp.*

Circle No. 28

Gas regulator

MEDIUM to light-duty service is range of a small gas flow regulator called "K-G Jeep." For use with most compressed gases, unit has a clear anodized body and back cap made of high-strength forged aluminum, with a tensile strength of 68,000 psi. Stainless steel is used for the filter and all internal working parts. High-pressure gages are graduated to 4,000 psi, adding a 1,000 lb. safety factor. *K-G Equipment Co.*

Circle No. 29



Pipe machine

REMOTE control with a wide range of speeds and a new method of centering and holding are featured in a new pipe machine. It handles 1½-in. to 12-in. diameter pipe and fittings, and lengths from 3 in. to 25 ft. The machine cuts pipe straight or beveled, aligns pipe to fittings; adjustable turning rolls give accurate control for quick alignment.

Combination power-driven and free-wheeling rolls turn a wide variety of weldments with swing clearance of 28 in. Especially for submerged-arc, inert-gas and metal-arc welding. *R. C. Porter Co.*

Circle No. 30

Testing aid

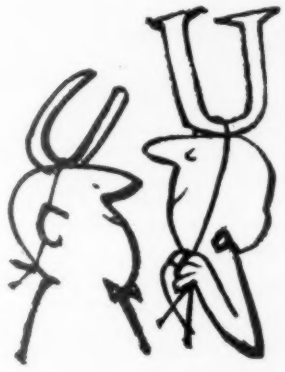
PERMANENT magnet "Leech" allows one man to do testing operations formerly requiring two. The "Leech" includes a permanent alnico magnet, cast steel pole pieces with aluminum carrying handle and 5 ft. of 2/0 cable. It will make electrical contact on any magnetic surface, including vertical and overhead members. Magnetizing source can be a-c, d-c or half-wave current not exceeding 1,500 amp. *Magnaflux Corp.*

Circle No. 31

Scarfing torch

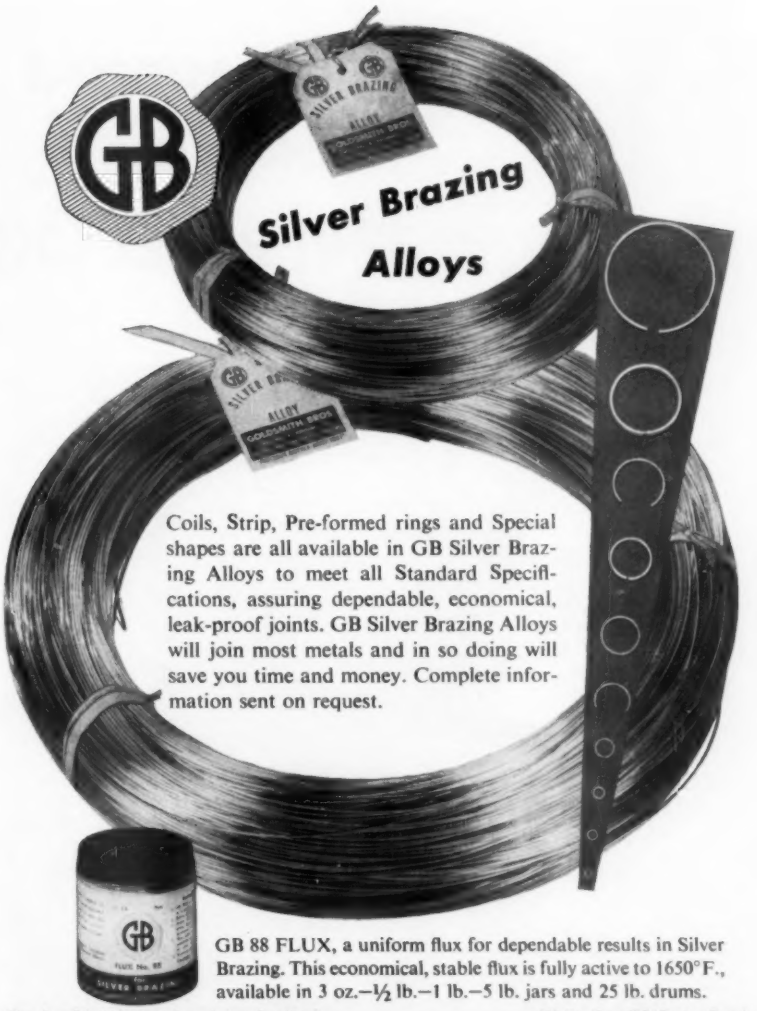
POWERFUL 3-hose scarfing torch is used in heavy duty work where large amounts of metal removal are desired. It has been tested at major mills in Pittsburgh and Chicago. The torch permits independent control of preheating and scarfing oxygen flows. *National Cylinder Gas Co.*

Circle No. 32



We're giving the United Way

How about you?


Silver Brazing Alloys
Coils, Strip, Pre-formed rings and Special shapes are all available in GB Silver Brazing Alloys to meet all Standard Specifications, assuring dependable, economical, leak-proof joints. GB Silver Brazing Alloys will join most metals and in so doing will save you time and money. Complete information sent on request.

GB 88 FLUX, a uniform flux for dependable results in Silver Brazing. This economical, stable flux is fully active to 1650°F., available in 3 oz.–½ lb.–1 lb.–5 lb. jars and 25 lb. drums.

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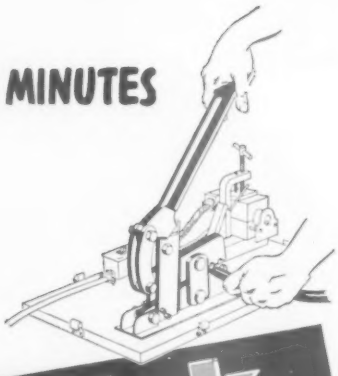
Vulcanized, permanent cable splices WITHOUT POWER LOSS

IN 5 MINUTES

IN YOUR OWN PLANT OR IN THE FIELD.



cam-lok

New Portable Kit . . . includes crimping press, cable cutter and vulcanizing mold.

New CAM-LOK portable Cable Splicing Kit produces vulcanized, neoprene insulated cable splices anywhere in just 5 minutes . . . makes them waterproof, shockproof.

Simply strip back insulation on cables . . . insert bare ends in copper tube supplied . . . crimp . . . place inner sleeve over crimp . . . vulcanize outer sleeve to cable jackets. No tools or experience needed . . . no production delays.

- Insulating sleeves are vulcanized to cable . . . can't pull away . . . prevents moisture from entering and damaging cable.
- Conductivity of splice is as good as the cable itself. Cables are crimped under great pressure into a pure copper crimping tube.
- Completed splice is tapered and only slightly larger than cable, so cable won't be caught on obstructions when dragged.
- Economical . . . because of low cost of components . . . allows you to splice as little as two, 2′ sections together, which might otherwise be wasted.
- Splice is flexible, because inner sleeve eliminates voids or weak spots in the insulation.
- Finished insulation of splice will withstand 2,500 volts without any leakage.

Bulletin No. 243 contains full information on this new Kit and Cable Splice. Write today for your copy.

CAM-LOK Division
Empire Products, Inc.
P. O. Box N-98, Cincinnati 36, Ohio

Rectifier welder

LIGHTWEIGHT rectifier type d-c welder has been developed to bring the advantages of Tig welding to light gage, but hard-to-weld, metals. Initial impact of full 15-amp current gives prompt arc starting with flexible downward range to 2.5 amp, maker claims. Extras include gas control valve and timer, for use of hand switch to initiate preflow of gas. *Miller Electric Mfg. Co., Inc.*
Circle No. 34

Synchronous starters

AUTOMATIC synchronization is possible with new synchronous starters for motors. Should the motor pull out of step because of voltage dip or overload, the field is automatically removed and re-synchronization occurs when the motor re-accelerates the load. Short circuit protection is provided by current-limiting power fuses working in conjunction with high-interrupting-capacity ZHA air-break contactor. *Square D Co.*
Circle No. 35

Industrial motors

"LIFE-line" industrial a-c motors have ratings from 40 to 125 hp. The motors can be obtained as totally enclosed fan-cooled, totally enclosed non-ventilated and drip-proof.

Motors are designed to operate at frequencies of 25, 50 and 60 cycles at 220, 440 and 550 volts. Speeds are 3,600 rpm and below. *Westinghouse Electric Corp.*
Circle No. 36

C-clamp

EXTRA-heavy duty "C" clamp is deep-throated and drop forged from steel. It is heat treated for uniform strength, manufacturer says. Designed with adjustable handle and floating swivel on the wide-threaded screw, it gives easy, fast adjustment. These parts are copper plated to resist adhesion of welding spatter. Developed for firms doing steel fabricating, iron welding, etc. Comes in seven sizes and weights, from 2 to 12 in. *Industrial Clamp Co.*
Circle No. 37

Safety hat

ALL-plastic safety hat passed federal specification tests for construction worker's hats and, for electrical workers, it can withstand 20,000 volts.

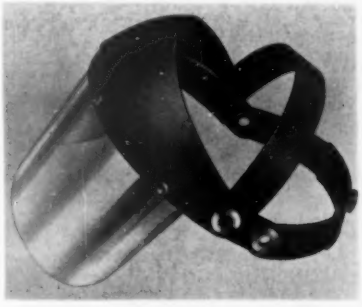
Headgear has soft headband which adjusts to sizes 6½ through 7¾. Both hat and cap are offered in white, yellow and gray. Non-metallic chin straps and winterliners are available. *Jackson Products.*

Circle No. 38

Templates

KIT of five rigid vinyl templates cover detailing profiles for fabricators and users of structural steel and reinforced steel, manufacturer states. Four cover such aspects of wide flange steel detailing as steel beam, column, pipe shapes, etc. Scales are ⅛ in., ¼ in., ½ in. and 1 in. The fifth template specializes in reinforced steel details, includes bar bends and hooks, bar size sections, concrete forms, etc. Complete kit is $17.50, individually $3.75. *A. Lawrence Karp.*

Circle No. 39



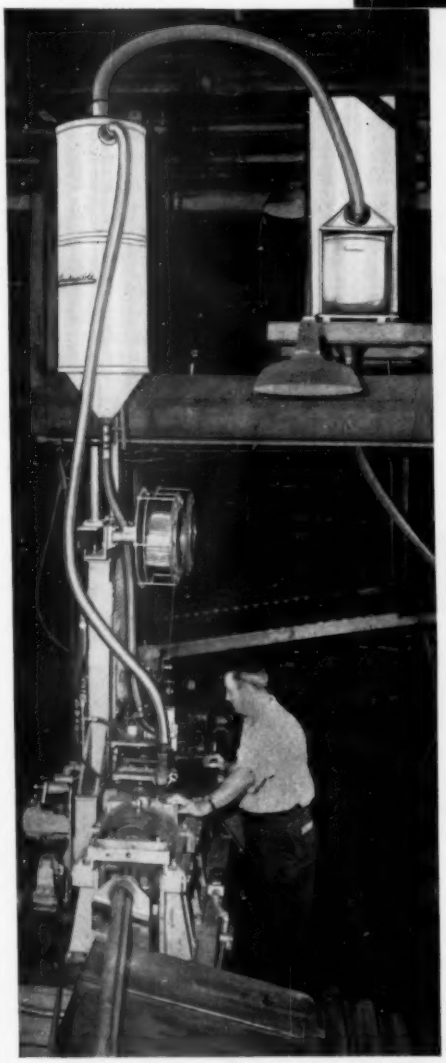
Heat protectors

WITH a new aluminized plastic cover plate for welding helmets, radiant heat is reflected away from the worker's face. It is especially good for Mig and Tig welding, manufacturer reports. Aluminized cellulose acetate face shield *(above)* enables worker to work longer on melting, forging, etc. Treated with evaporated aluminized coating, windows reportedly last four times as long as untreated shields. They are available for all "AO" face shields of the "H" series. *American Optical Co.*

Circle No. 40

Savings in reclaimed flux alone have paid for Invincible units in a few months, or even weeks, on submerged arc welding jobs.

INVINCIBLE
Welding Flux Recovery Systems
MAKE 3-WAY SAVINGS



Operating continuously, this Invincible recovers all unfused flux from pipe-seam welding operation at a leading automotive firm.

1 *Valuable Flux Reclaimed. Automatic* Invincibles recover *all* unfused flux and return slag-free, dust-free usable flux to the welder—*all in one continuous operation.*

2 *Costly Man-Hours Saved.* Invincibles do the complete job automatically—far more swiftly and efficiently than manual methods.

3 *Fewer Expensive Rejects.* Invincibles remove all fine dust (flux flour), thus reducing welding rejects and speeding production.

Many Important Advantages

- Ruggedly built to resist abrasive nature of flux.
- Compact and lightweight. Variety of models and flexibility eliminate need for tailor-made installations.
- Portable units also available.

WRITE TODAY FOR FOLDER on Invincible Flux Recovery Systems.

INVINCIBLE VACUUM CLEANER MFG. CO.
DOVER, OHIO

WELDERS PREFER IT...

...IT'S SPECIALLY DESIGNED for 3-WAY SUPERIORITY

- 30% more heat resistance than any other make—wrap around glass fibre tip insulation.
- Body completely insulated, there are no bare spots.
- Red Tips and Trigger . . . bright Yellow Handle . . . an outstanding safety feature . . . quickly identifies Hi-Amp Holders.

HI-AMP®

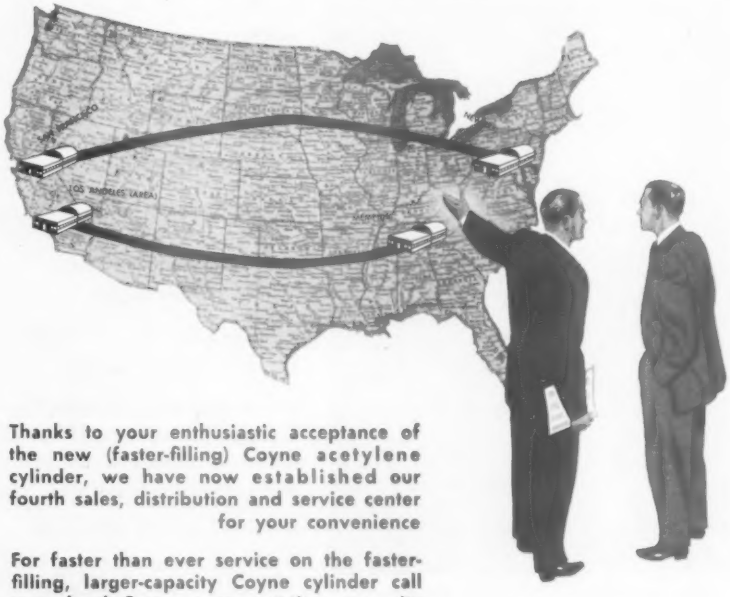
ELECTRODE HOLDERS
TWO WAYS MORE ECONOMICAL, TOO

OTHER WELDING ACCESSORIES

HI-AMP

SEE YOUR WELDING SUPPLY DEALER

LENCO INCORPORATED
JACKSON, MISSOURI



Thanks to your enthusiastic acceptance of the new (faster-filling) Coyne acetylene cylinder, we have now established our fourth sales, distribution and service center for your convenience

For faster than ever service on the faster-filling, larger-capacity Coyne cylinder call your local Coyne representative, or write direct to the location nearest you

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200 PAUL AVE., SAN FRANCISCO, CALIFORNIA
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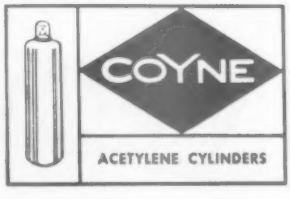
24 COMMERCE ST., NEWARK, NEW JERSEY



Rectifier

COMPACT 23 kw silicon single phase bridge rectifiers have been engineered for heavy power conversion in high ambient temperatures. Designed for forced air or natural convection cooling, the units consist of four silicon junctions mounted on a heat exchanger for optimum cooling.

Rectifier stack is rated at 50 amp, rectified d-c when convection cooled, and 120 amp rectified d-c when force air cooled at 1,000 lfm. Maximum input voltage per junction is 300 PIV, or 210 volts rms.

Units were designed for welders, alternator rectifiers, etc. *International Rectifier Corp.*

Circle No. 41

Duct hanger

BECAUSE of the unusual design of a two-piece lay-in duct hanger, there are more than 20 different ways to install. Location of duct runs is no longer a major problem, manufacturer says.

A complete line of fittings, lengths, connectors, T's, L's, junctions, telescopes and pull boxes is available. New joint design assures rigidity in the duct run.

Hinge cover and screw cover types are interchangeable and use the same fittings. *Square D Co.*

Circle No. 42

Ferruling tool

LATEST ferruling tool eliminates dangerous hose connection, does professional job without skill, manufacturer claims. Crimp ferrules on 3/16 in. or ¼ in. twin or single hose. *Craig Welding Supply Co.*

Circle No. 43

Error shows WE not goof-proof

On page 88 of the June WELDING ENGINEER we incorrectly reported, through a typographical error, the measurements of Sellstrom Mfg. Co.'s new face shield. Coverage around the face is 19 in., with a choice of either 8 or 10 in. window height.

NEWS . . . . . *from page 6*

erected at least 25% faster than before.

For the first time, the Michigan state highway department used studs as shear connectors. About 8,500 Nelson headed studs, ¾ in. in diameter by 4 in. long, were end welded to the beams of a bridge just completed at Farmington. The studs bond the steel

beams and concrete slab together so they act as a unit and reduce the amount of structural steel required in the bridge. Results were so good that stud shear connectors are now planned for future bridges.

CGA announces new members

The Compressed Gas Association, New York City, approved the membership applications of Alabama Oxygen Co., Birmingham; Anchorage Oxygen Co., Anchorage, Alaska; Big Three Welding Supply Co., Ft. Worth, Texas; California Oxygen Co., San Francisco; Kansas Oxygen, Inc., Hutchinson, Kan.; Wall Gases, Inc., Morrisville, Pa.

AISI underwrites Battelle program

For the ninth straight year, the American Iron and Steel Institute is underwriting a special high-purity iron program at Battelle Institute to find a purer iron by developing better processing methods.

Eutectic expands overseas plants

Brazil and Switzerland are scheduled to get new Eutectic Welding Alloys Corp. plants. The announcement followed soon after dedication ceremonies for a new plant in London, England.

Expanding South American industry called for a new plant in Sao Paulo, Brazil. It is now being equipped. At the same time final plans for a new plant in Lausanne, Switzerland have been completed. The plant is expected to be finished early in 1958.

The Lausanne plant will double Eutectic's continental European production.

Norelco to show new instruments

The new Philips Electronics, Inc. contact microradiographic unit and projection microradiographic unit (X-ray microscope technique) will be shown for the first time at the November Metals Exposition in Chicago.

Other instruments of the Mount Vernon, N. Y., firm to be shown at the National Metal Exposition & Congress will include the emission microscope, bulk specimen and 3-specimen spectrograph units. The 24-element Autrometer, X-ray diffractometer, X-ray spectrograph, X-ray diffraction unit with cameras, plus ratemeters, scintillation and proportional counter equipment will be part of the exhibit.

Aufhauser Brothers move company

Aufhauser Brothers Corp., makers of bronze rods for gas welding, has recently moved from 575 Madison Ave., in New York City to 830 Willis Ave., Albertson, N. Y.

Film outlines repair job

A new Martin color film illustrates how to repair aluminum honeycomb structure under field conditions. It is available to industry.

The film shows a 6-in. puncture in the trailing edge of a wing being repaired by two men with tools and materials in a single cart. The four hour operation is reduced to essentials in the film—running time is 10 minutes (16 mm film). For loan of the Martin Honeycomb Repair film write to: Presentations Section, Martin Co., Baltimore, Att: Ann Juliano, Mail No. J-376.

Danny says:

"Slag removal is a snap with Airco 78E electrodes"

I find that easy slag removal is just one of the many advantages of Airco 78E electrodes. This deep penetrating, all position electrode produces high quality weld metal which sets up rapidly. It's free from porosity, even when welding in the vertical down position. I especially recommend it for welding mild steel where high ductility and tensile strength are essential.

Why not send for the free Airco Electrode Guide which will help you select the right electrode for your specific job. Request catalog 1318.

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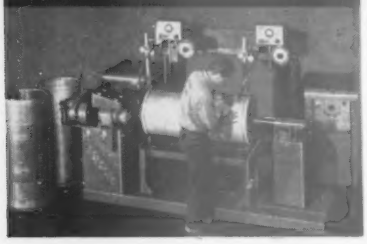
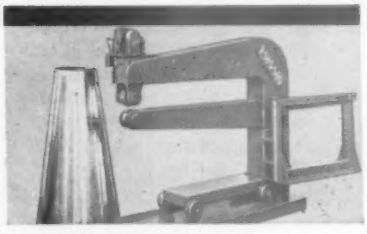
how to make fusion butt welding a *push-button operation*



CIRCUMFERENTIAL
automatic welding fixture
Designed for circular welding of components with automatic chucking and ejection of parts and transfer. Chuck expands internally for sizing. Surface speed to 300″ per min.

LONGITUDINAL *automatic fusion butt welding fixture*
Hold-down fingers with "toe touch" control lock parts in position for welding. Back-up mandrell with up to 6 copper inserts permits fast job changes. Handles all weldable metals .005 to 1″ thick and lengths from 2′ to 12′.



ROLL PLANISHING FIXTURE
Cold-rolls and smoothes fusion welds (circ. & longit.) under controlled pressure up to 10 tons. Handles 1¼″ to 10′ dia. and lengths to 16′.

Write today for further information
785 No. Prairie Ave., Hawthorne 2, Calif.

Airline WELDING
WELDING & ENGINEERING
FIXTURES & POSITIONERS
"guides the arc to the mark"

Ice rink has cradle structure

An unusual cradle structure made easy the fabrication and handling of lengthy pipe sections used in installing an outdoor ice skating rink at Branch Brook Park, Newark, N.J.

Use of the cradle minimized weld stress and reduced the possibility of bends in long pipe sections. Once short pieces of pipe were welded into a 200-ft length, the piping was rolled over the edge of the cradle and positioned on a temporary platform. The cradle was developed by Peter Carver Associates, New York City, and fabricated by Richardson and Richardson Co., Nutley, N.J.

Fifty-seven tons of wrought iron piping was used in the rink, which is located in an abandoned wall-type reservoir. A total of 45,360 ft of 1/14-in. diameter pipe was used as well as 5,040 ft of 1¼-in. extra heavy wrought iron pipe.

Welded pipeline for South America

Creole Petroleum Corp. will weld and submerge 110,000 ft of aluminum oil-carrying pipe in brackish Lake Maracaibo. The Venezuelan oil producer will use the lines to transport crude oil from off-shore wells to off-shore flow stations.

The pipe, to be supplied by Aluminum Co. of America, will be submerged in water up to 90 ft in depth. The decision to lay 22 miles of pipe followed an inspection of a pilot line installed in 1955. After two years' service, the pipe is in excellent condition.

Airco builds in Acton, Mass.

Air Reduction Sales Co. recently broke ground for its multi-million dollar air separation plant which will produce 75 tons of liquid oxygen, nitrogen and argon per day. The Acton, Mass., plant is Airco's fifth. It should be completed during the summer of 1958.

NO INJURIOUS FUMES . . .

"ANTI-BORAX"

No. 2 BRAZING FLUX

For Brass, Bronze, Copper, Steel, Malleable Iron, etc. Causes the bronze to penetrate deeper into the joint—making a stronger union than is possible with other fluxes. High efficiency makes it more economical to use. Melting point 300°.

ALSO

1—Cast Iron Welding Flux
3—Brass, Bronze Welding Flux
4—Flux for Bronze Welding Cast Iron
5—Extra Quality Aluminum Flux for Cast Aluminum Welding
7—Steel Flux
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9—Stainless Steel Flux
11—Tinning Compound
12—Burnt Cast Iron Welding Flux
13—Brazing Flux for Extruded Bronzes
14—Special Brazing Flux for Aluminum Bronze, Everdur, and all Silicon Bronzes
15—Special Flux for Magnesium Alloys, Dow Metal, etc.
16—Silver Solder Paste Flux

FOR THE BEST JOB AT LEAST COST

Weldors can save more money and get a better job on production work, making special tools, and repair work with the right Anti-Borax product—**order by number.** Send for **free sample** and descriptive Circular.

ANTI-BORAX COMPOUND CO., INC.
FORT WAYNE, INDIANA

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Gloves—Garments

WELDORS BUY FROM YOUR DEALER

ASK FOR OUR NEW CATALOG

BRAZILIAN DEERSKIN
THE "STAY SOFT" LEATHER
GLOVES AND MITTENS

TILLMAN PRODUCTS
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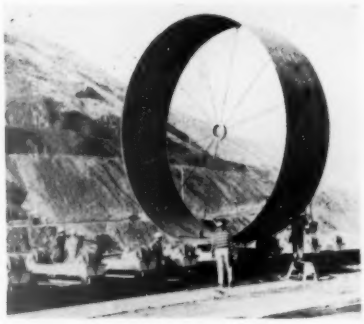
Long Beach, Calif.



Penstocks welded at Brownlee Dam

Turning rolls aid in welding huge steel tubes, 28 ft in diameter, which form the penstocks in four 500-ft tunnels built through solid rock in the Brownlee Dam power development project. It is the first of three developments on the Hells Canyon stretch of the Snake River in Idaho.

Steel sections, 7½ ft long, 12 ft high and more than an inch thick, are delivered to the dam already rolled in semi-circular sections. Turning rolls are set up in stations of one powered roll and four idlers.

The first step in fabricating the tube is to attach a spider to one of the semi-circular sections to brace the sections. To form a portion of the tube, welds are laid longitudinally on each seam while the sections are on the roll.

Each station has a 60-ton rotating capacity. In the second stage of assembly, two stations are coupled together. For final welding, power rolls of all four stations are synchronized to form a tube about 60 ft long.

Gulton buys CG Electronics

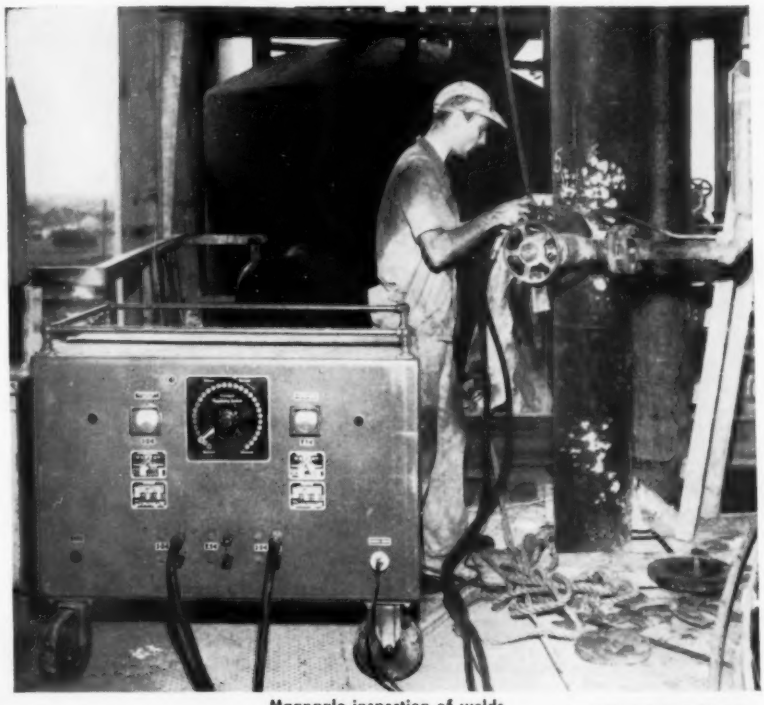
C. G. Electronics Corp., Albuquerque, N.M., will operate as a wholly-owned subsidiary of Gulton Industries, Inc., Metuchen, N. J. The New Mexico firm, producers of radio control equipment for industry, model making and aircraft, will retain its corporate identity, despite its recent acquisition by Gulton.

Olin expands in research

Olin Mathieson recently got underway a four-year expansion program on new facilities for the development and production of high-energy solid propellants for rocket engines.

New research and development laboratories, pilot plants and test and production facilities are being built near Marion, Ill.

Fast • Positive • Low-Cost Inspection of your critical WELDS



Magnaglo inspection of welds

Call **MAGNAFLUX**
NATION-WIDE
COMMERCIAL
INSPECTION SERVICE

AVAILABLE ANYWHERE • ANYTIME

To help you get fast, positive and low-cost inspection of your *critical* welds, *Magnaflux Corporation* has a nation-wide *Commercial Inspection Service* on call when and where *you* want it—in the field or at your plant.

Magnaflux Commercial Inspectors know welding . . . and are *factory trained* in working with all Magnaflux testing methods. They know that it is just as important to recognize *good* welds as it is to find defective ones. Their job is to assure you consistent weld quality, as well as to help you cut your welding costs . . . and build welding business and acceptance through good welds!

When welds are critical, it's good business to have them inspected the *Magnaflux* way. Welds—pressure vessels, heavy machinery, piping and all kinds of heavy equipment—may require precision inspection yet must be done on location. That is where the *Magnaflux Field Inspector* and his mobile test equipment of many types are most valuable. He arrives on *your* schedule fully equipped to perform complete inspections. He not only tells you *what* and *where,* but *how* defects occur. Then, through better job control and working techniques, you'll get more good welds, fewer rejects and less rework.

Small parts weldments can be inspected in the nearby Magnaflux Commercial Inspection Plant. The same fast, positive, low-cost service prevails. Get the nearest telephone number from the list below.

With *Magnaflux Commercial Inspection Service* you get the benefit of a nation-wide standard of inspection . . . by Magnaflux-trained experts using genuine Magnaflux Test Systems: Magnaflux-Magnaglo, Zyglo, Sonizon ultrasonic testing and others.

Write for full details now—
OR CALL ANY OF THE COMMERCIAL INSPECTION BRANCHES SHOWN BELOW.

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Newark 4, N. J. HUmbolt 3-1235	Pittsburgh 36 TUxedo 2-3448	Indianapolis 18 LIberty 7-1303	Houston 23 WAlnut 3-9169
Hartford, Conn. JAckson 8-6844	Cleveland 15 HEnderson 2-0727	Los Angeles 22 RAymond 3-8561	Chicago 39 EVerglade 4-1561
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ALLOYS and FLUXES All-State

for welding • brazing • soldering • tinning • cutting

Users Report on Cams: "Using your No. 13 rod to build up such surfaces, we have had 3 to 5 times the cam life."

Users Report on Wrist Pin Holes in 500-lb. Pistons: "No. 13 enabled successful repair where 200 degrees more heat would have spoiled everything. There was no warpage."

For Instruction Book on 62 alloys and fluxes write *All-State Welding Alloys Co., Inc. White Plains, N. Y.*

ALL-STATE ALLOYS AND FLUXES

REQUEST COMPLETE LIST OF THESE PRODUCTS FOR PROBLEM SOLUTIONS

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and You're Ready to GO on ANY Welding Job!

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- NO MORE OPEN FLAMES
- NO MORE LOSS OF TIME
- SPEEDS UP PRODUCTION
- COSTS LESS THAN 20¢ A MONTH TO OPERATE

Welders EVERYWHERE have been waiting for the unmatchable advantages of the THERMO "TORCHIE"—the Magic Lighter. Yes, it's the ultimate answer for a fast, safe economical lighter. It never MISSES . . . All the Welder need do is s-w-i-s-h the torch tip within a few inches of the top, and BINGO! an instantaneous *sure* light.

Just Test One on 30 Day Money-Back Guarantee

—that's all we ask, and you'll find as others have, that no Welder will part with it—once he tries it! See your Welding Supply Distributor TODAY — or write us for name of one near you—don't put it off; costs only $9.95.

Will last indefinitely.

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LEFT to right: Dick Hayes, secretary; C. P. Sanders, AWS national president; D. P. O'Connor, chairman and John Ross, vice chairman. All but Sanders are new LA officers.

Los Angeles AWS holds executive meeting

The last AWS Los Angeles section executive meeting for 1957 was held recently at the Biltmore hotel in Los Angeles. AWS national president "Sandy" Sanders spoke, and each chairman reported his activities. Charles B. Smith, retiring chairman of the section, presided.

Later, for the 13th annual reunion night, a barbecue was held in honor of past chairmen.

Navy employs new technique

Capacitance welding is used in the Navy's new technique for attaching thermocouples to workpieces, making it easy to measure the temperature of material.

Thermocouple wires are welded individually to the workpiece through discharge of a bank of charged capacitors. Weld characteristics are controlled with a potentiometer. The welder is portable and operates from standard power supply. Portability of the welder eliminates the need for heavy equipment.

NYU titanium lectures feature French experts

Two leading French authorities on titanium will speak at the titanium lecture program at New York University September 9 through 13. Among the subjects to be covered are physical metallurgy, corrosion and fabrication.

ATC changes home, name

Automatic Temperature Control Co. moved into a building twice the size of its former home, and changed its name to boot. It is now Automatic Timing & Controls, Inc.—more descriptive of the product lines manufactured by the firm for industrial automation, the company feels.

The firm moved from Philadelphia to King of Prussia, Pa.

A FAR cry from the little red schoolhouse is this modern all-welded elementary school in Orleans Parish, New Orleans, La. (See story below.)

Welding builds schoolhouse in sky

The all-welded Phillis Wheatley elementary school in New Orleans, La., is erected 10 ft off the ground on two rows of 10 concrete foundation piers to give a large, open center play court as well as an area beneath classrooms. The block-long building is 312 by 104 ft, with 12 cantilevered rectangular trusses forming 27 ft, 6 in. bays and tieing into floor and roof framing.

Classroom wings overhang the supporting piers by 35 ft on either side. They are partially shop welded, then field spliced by groove butt and fillet welding. Steel sections are wide-flange beams with bulb tee roof purlins and a wide variety of reinforcing and trim elements, including channels, plates and I-beams. They total better than 300 tons.

The welded design gives clean, smooth lines important in the permanently exposed framing. It also gave 15% saving in steel tonnage over riveted design. The Lincoln Electric Co. supplied the E6010 type welding electrodes used on the job.

Tracerlab opens Dutch plant

Besides a Paris office, Tracerlab, Inc. of Waltham, Mass., has opened a subsidiary in Amsterdam, Holland. It will be called Tracerlab (Holland) N.V.

Zirconium, Zircaloy 2 go nuclear

Reportedly the first welding fittings of zirconium and Zircaloy 2 have been designed for nuclear energy application. The fittings, forged by Tube Turns, Louisville, Ky., have an outside diameter of 1.5 in. and a 0.065 in. wall.

In chemical and nuclear fields, zirconium and Zircaloy 2 are being used in increasing amounts where severe corrosion conditions are met.

The materials resist corrodents and have low thermal cross sections. In nuclear reactor installations, they have a high degree of stability under radiation.

Britain shows welding equipment

New welding equipment will be shown at Britain's Engineering, Marine & Welding exhibition which opens in London August 29. Among exhibitors are: Crompton Parkinson Ltd., showing a new range of transformer rectifiers for stud or arc welding, and British Industrial Gases Ltd., exhibiting a super heating torch designed to operate on oxypropane for operations requiring more heat than is possible with oxyacetylene.

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looks like a crayon... marks like a crayon... tells temperatures like a precision instrument!

Available in these Temperatures (F.)

113	375	1000
125	388	1050
138	400	1100
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163	425	1200
175	438	1250
188	450	1300
200	463	1350
213	475	1400
225	488	1450
238	500	1500
250	550	1550
263	600	1600
275	650	1650
288	700	1700
300	750	1750
313	800	1800
325	850	1850
338	900	1900
350	950	1950
363		2000

Sixty-three different compositions enable you to determine and control working temperatures from 113° to 2000° F.

TEMPILSTIK° marks on workpiece "say when" by melting at stated temperatures — plus or minus 1%.

ALSO AVAILABLE IN LIQUID AND PELLET FORM . . . WRITE "WELDING SALES" DEPT. FOR SAMPLE TEMPIL° PELLETS . . . STATE TEMPERATURES OF INTEREST—PLEASE!

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VISIT OUR BOOTH—No. 1041 at the CHICAGO METAL SHOW, November 4-8, 1957

ARCAIR TORCH CUTS STEEL PILING WITH BACKFILL IN PLACE—SAVES 50%

Fifty-year-old ⅝" steel piling was cut into convenient lengths by the Arcair Model H-3 Torch with backfill dirt and concrete still in place. The contractor saved 50% on cutting costs and saved more because he had bulldozers and pneumatic chipping hammers on the job only two days instead of ten. The Arcair Torch and Copperclad Electrodes used ordinary DC welding machines for a power source and common 100 psi air pressure to cut thousands of feet of piling during the replacement of a Chicago & Northwestern Railway bridge in Evanston, Illinois.

For full details on this project, and for complete information on the cost and time-saving Arcair Model H-3 Torch, write today.

Arcair **Company**

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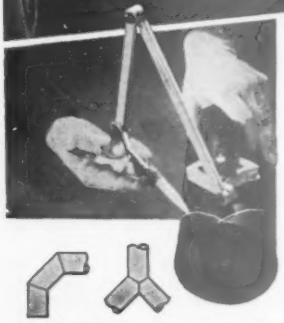

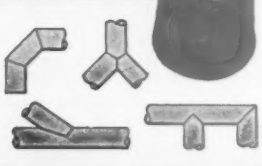

SAVE TIME AND MONEY!

A SMOOTH SWING of the Contour Marker's soapstone point and you're ready to cut! It's easy and *absolutely accurate* because there is an angle dial calibrated in both degrees and pitch. Any of the pipe joint angles shown can be marked off in minutes. And you save "man hours" as well as oxygen and acetylene gas because "cut and try" methods are completely eliminated. Two sizes are available complete with adapter for marking structural steel. Standard, for pipes from 1½" to 18" dia.; Jumbo, for pipes from 16" to 48" dia. Instruction book included. Belt case available. Write for information

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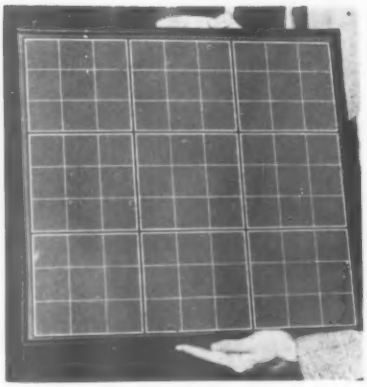
THE CONTOUR MARKER



CHECKERS anyone? Not on this selenium sun battery developed to convert solar energy to electrical current. Battery consists of nine 6-in. by 6-in. International Rectifier B-60 selenium cells.

Reliance Electric, Master Electric merge

Reliance Electric & Engineering Co. and Master Electric Co. have consolidated. Reliance produces electric motors and electronically controlled drive systems. It operates plants at Cleveland, Euclid and Ashtabula, Ohio, at Columbus, Ind., and Welland, Ontario.

Master produces fractional-type a-c and d-c motors, special gear motors and other special rotating electrical equipment. Its plant is in Dayton, Ohio. It will now operate as the Master Electric Div. of Reliance Electric & Engineering Co.

Westinghouse builds new Charlotte plant

A new Westinghouse manufacturing and repair plant will be located on 6½ acres about 3½ miles northeast of the Charlotte, N.C., business district. The 24,000-sq ft building is scheduled for completion in mid-1958. It will be brick, concrete block and steel. A 25-ton crane and modern electrical repair facilities will handle repair work on heavy industrial and utility equipment.

For 32 years the plant has been in Charlotte.

Norton installs steam equipment

Steam generating equipment will increase the capacity of Norton Co.'s main power plant by 75%. It is the final project of the firm's expansion program. Over a million dollars will be spent on the boiler, power house addition and new coal handling equipment.

COMING EVENTS

SEPT. 12-13: NWSA Central Zone Meeting, Sheraton-Gibson Hotel, Cincinnati.

SEPT. 16-17 NWSA Eastern Zone Meeting, Commodore Hotel, New York City.

OCT. 7-9: National Electronics Conference, co-sponsor Illinois Institute of Technology, Hotel Sherman, Chicago.

OCT. 21-25: National Safety Congress, Chicago.

OCT. 27-NOV. 1: Fourth Annual conference, Atomic Industrial Forum, Second Fall meeting American Nuclear Society, and Trade Fair of Atomic Industry, Coliseum, New York City.

NOV. 4-8: Thirty-Ninth National Metal Exposition & Congress, concurrently with Second World Metallurgical Congress, American Society for Metals, International Amphitheatre, Chicago.

NOV. 11-12: NWSA West Central Zone Meeting, The Cosmopolitan, Denver.

NOV. 14-15: NWSA Western Zone Meeting, Riviera Hotel, Las Vegas.

DEC. 2-3: NWSA Southeastern Zone Meeting, Atlanta Biltmore, Atlanta.

DEC. 5-6: NWSA Southwestern Zone Meeting, The St. Anthony, San Antonio.

MARCH 19-21: Fifty-eighth Annual Convention, International Acetylene Association, Bellevue Stratford Hotel, Philadelphia.

APRIL 14-18: Sixth Annual Welding Show, American Welding Society, Statler and other hotels, St. Louis.

APRIL 14-18: Sixth Spring and Thirty-ninth Annual Meeting, American Welding Society with American Society of Mechanical Engineers Conference, St. Louis.

MAY 5-8: Fourteenth Annual Convention, National Welding Supply Association, Americana Hotel, Miami Beach, Fla.

M & T initiates research program

To seek new ways to produce pure metals, Metal & Thermit Corp. has started a long-range research and development program.

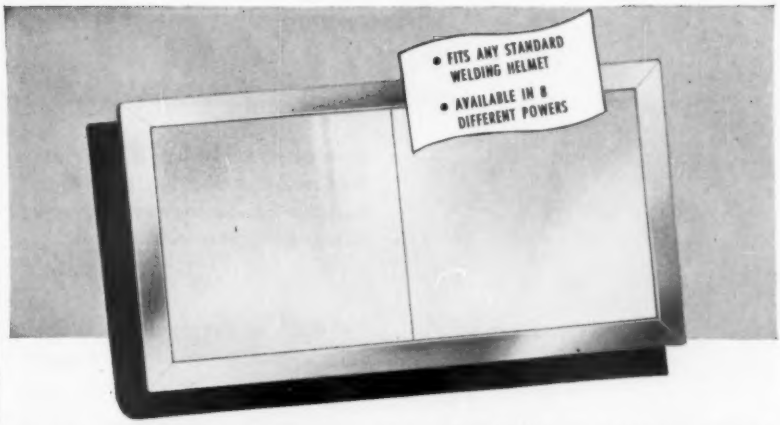
The program will be headed by Dr. C. K. Banks, vice president of research. He plans to work on methods to produce transition and refractory metals which meet supersonic and atomic age demands. The program will cover molybdenum, tungsten, titanium, zirconium, etc.

Distributor appointments

Joseph T. Ryerson & Son, Inc., Los Angeles: Arizona Steel Co., Phoenix, Ariz.

General Electric Co., Schenectady, N. Y.: Weber Air Conditioning, Pittsburgh, Pa.

K-G Equipment Co., Allentown, Pa.: California Oxygen Co., Los Angeles.



Better Welding Vision For All Bifocal Wearers!

NEW SELLSTROM MAGNA-WELD PLATE

The welder who requires bifocal glasses can now enjoy "full window" vision with the SELLSTROM MAGNA-WELD PLATE. This new optical aid provides magnification for near vision and can be fitted behind colored filter plates in any standard welding helmet.

HOW MAGNA-WELD HELPS

WITHOUT — Helmet wearer cannot use large upper portion of his glasses . . . limited near vision obtained only through bifocal segment.

WITH — Wearer now obtains magnification for near vision provided by MAGNA-WELD throughout entire window area.

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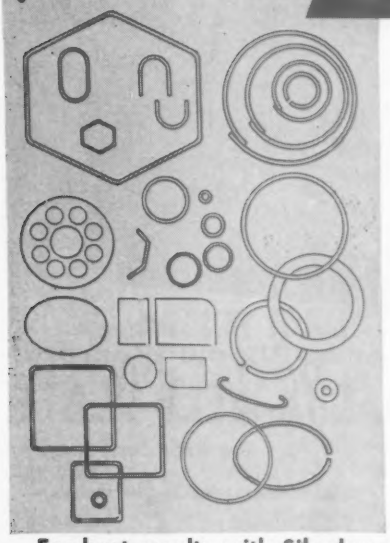

Silvaloy Silver Brazing preforms for Production Brazing. . . . Rings, stamped or coined washers, wire forms, wire, strip and powder.

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Technical service men are available to assist you in the proper joint design.

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All inquiries given prompt and immediate attention . . . shipments made on short notice.

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gets tougher and tougher under severe impact and abrasion . . .

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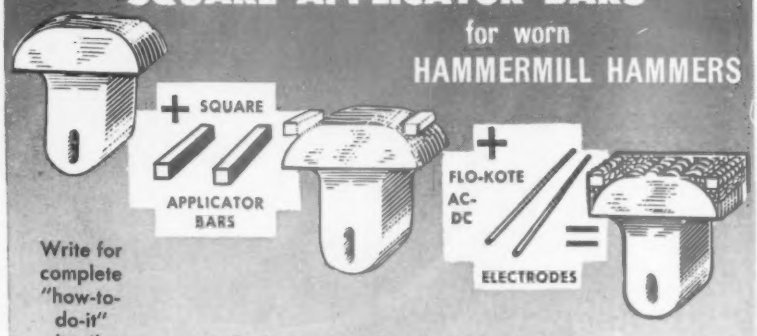
T.M. Reg. U.S. Pat. Off.

11%-13½% MANGANESE-NICKEL STEEL

SQUARE APPLICATOR BARS

for worn HAMMERMILL HAMMERS



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- Outlast new parts — cost less.
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- Polish to slick finish — less friction wear.

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NEAREST DISTRIBUTOR UPON REQUEST

Chief engineer of A. O. Smith Corp.'s Welding Products Division is *R. J. Keller*. He had been assistant to J. J. Chyle, Smith's welding research director. Keller will be in charge of engineering for the company's three welding products plants at Milwaukee, Elkhorn, Wis., and Leola, Pa. He has been with Smith since 1939.

Floyd K. Nye has been promoted to general manager of Buck Mfg. Co., San Jose, Calif. He has been secretary-treasurer of the company. Nye had been with Broeker and Hendrickson in St. Paul, Minn., as a certified public accountant.

Robert C. Eckert, Kirk H. Sterling and *Francis X. Sullivan* have recently joined the Lincoln Electric Co.'s district offices at Baltimore, Charlotte, N. C., and North Haven, Conn., respectively. All three were in the firm's training program at the home plant in Cleveland.

General superintendent of the Pacific Coast Engineering Co., Alameda, Calif., is *James Biggers*. His new duties include developing production methods in steel fabricating. For the past five years he has been plant superintendent for Dresser Industries, Bradford, Pa.

Burke

Townsend

In charge of sales in Illinois, Indiana, Michigan and Wisconsin is *Thomas A Burke, Jr.*, of Tweco Products, Inc. He has been named north central district manager. Burke was formerly with Machinery and Welder Corp. *James L. Townsend* joins the Tweco administrative staff at the Wichita, Kansas, office.

A. William Fraser will be Worthington Corp.'s new general marketing manager. He succeeds *William A. Meiter,* who takes over as a vice president. Fraser was commercial vice president in charge of district sales offices at Chicago, Denver, Kansas City, St. Louis, and Minneapolis. He completed Worthington's graduate student engineer training course after graduating from Northeastern University, Boston.

Fraser

Recently promoted by Chicago Bridge & Iron Co., Chicago, were: *Fred L. Golsby,* assistant to the president; *S. C. Hamilton,* vice president and general sales manager; *K. W. Lange,* Houston district sales manager.

Roy L. Hoeck has been appointed New York district sales manager of Magnethermic Corp., Youngstown, Ohio. He will headquarter in Westfield, N. J.

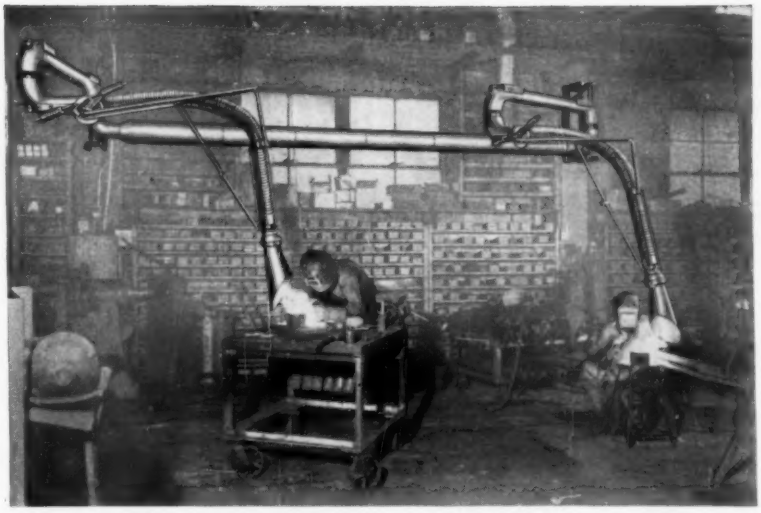
K-G Equipment Co. has promoted *Norman M. Kordwitz* to merchandising manager, and *Albert W. Lauer* to engineering director. Kordwitz will be responsible for coordinating sales, merchandising and advertising for the Allentown, Pa., firm. Lauer will direct new products and methods.

Manager of Mitchell Radiation Products Corp., Norristown, Pa., is *Robert S. Rebalsky.* He is a former agency representative for Dun & Bradstreet, Inc.

H. D. Barnes, manager of defense products for A. O. Smith, has been assigned to manage the company's atomic equipment section. He will coordinate research and engineering activities for the manufacture of atomic energy equipment.

Sales manager for the St. Louis steel service plant of Joseph T. Ryerson & Son, Inc. is *Wilford O. Schwartz.* He started with Ryerson in 1936 in the mail room.

At the recent meeting of the executive board of the Compressed Gas Association, Inc., *Pierre Salbaing* was appointed to fill the unexpired term of former board member *Andre Lot,* who returned to France.



Keep Plant Air CLEAR of Welding Fumes

Welding shops equipped with Ruemelin Fume Collectors are assured of a clean, healthful atmosphere. Harmful fumes, heat and smoke are eliminated *at their source,* before they have a chance to spread throughout the shop. This lessens fatigue . . . improves working conditions . . . paves the way for increased plant production. Ruemelin Fume Collectors are approved by Industrial Commissions and insurance companies. Thousands in service. Available with 9 ft., 15 ft., 17 ft. and 20 ft. reach. Write for Bulletin No. 37-E.

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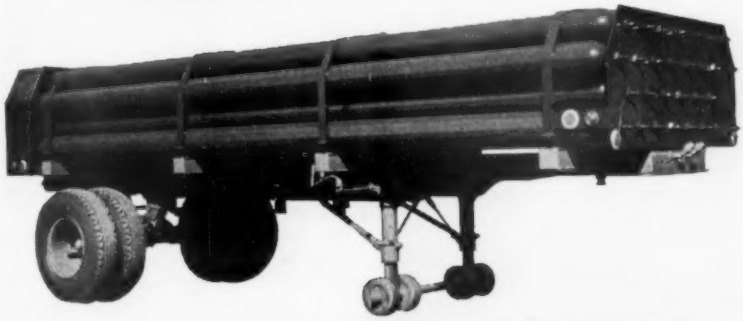
TRANSPORTING — Argon — Carbon Dioxide — Helium — Nitrogen — Oxygen — Boron Trifluroide — Hydrogen — Ethylene. Trailer capacities from 187,000 cu. in. to 750,000 cu. in. water capacity. Trailer tubes ICC3A-2400 Specifications with 2400 PSIG Working Pressure.



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For PROTECTION you NEED with the COMFORT you WANT

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Excellent protection for spot welding, grinding, buffing, acid pouring. Fiber forehead shield. Contour headgear. Easy, window replacement without tools.

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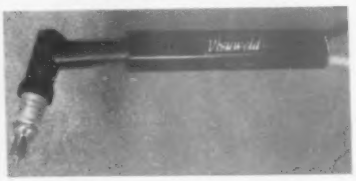
TIG WELDING

Made Easy With

"Visuweld" Torches



VISUWELD torches improve and simplify tig welding by giving faster and better welds with less effort and minimum torch maintenance.

- The lightest and smallest 350 amp TIG welding torch with super maneuverability.
- Only TIG torch made with standard size transparent cup that guarantees absolute welding visibility.
- NO SPARE PARTS NECESSARY. No gaskets or parts to 'screw together'.
- VISUWELD contained unit torch head guarantees no water or gas leakage, and the coolest TIG welding torch ever designed.

Perfect welds at welding ranges from 3 to 350 Amps eliminates the need for 'standby' torches. VISUWELD torches are 3 torches in 1.

TEC TORCH CO., Inc.

300 Paterson Ave. Carlstadt, N. J.

William Jetter Sr. has been appointed sales representative for C. G. Notley & Co., Inc. He will serve the southern part of Florida. Jetter was formerly vice president of Mid-States Welder Mfg. Co., Chicago.

John D. Knox is head of project engineering for Adamas Carbide Corp., Kenilworth, N. J. Knox was with Firth Sterling Inc., McKeesport, Pa., for 15 years and with Sintercast Corp. of America, Yonkers, N. Y.

Charles E. Huddleston has been chosen director of engineering at Lewis Welding & Engineering Corp., Cleveland. He will deal with the firm's expansion into creative design and building of specialized machinery and equipment. Huddleston was formerly with Olin Mathieson Chemical Corp. in Hamden, Conn.

Named to represent the medical gas section of Air Products, Inc., in the east is *Ralph Terrill*, Middlesex, N. J. *Allan Boyle*, Allentown, Pa., will represent the firm in the Lehigh Valley.

Metal & Thermit Corp.'s new treasurer is *Elden L. Kries*. At the same time *K. E. Doud* was appointed assistant manager of engineering and promoted were: *D. W. Oakley*, from technical advisor to the president to production manager; *H. A. Rack*, from production manager to manager of engineering; *C. H. Carpenter, Jr.*, from assistant manager of market development to technical advisor to the president.

Herb Hose, Ampco Metal, Inc., is back at work on a part-time basis after being seriously injured Oct. 3 in a boiler explosion which demolished much of the firm's Milwaukee office.

Adrien F. Busick, Jr. has been appointed executive vice president and general manager of Marion Power Shovel Company, Marion, Ohio. He had been vice president of engineering.

E. G. Counselman has been appointed manager, industrial sales, for H. K. Porter Co., Inc. He will headquarter in New York. *William E. Haines* has been named Washington representative to succeed Counselman.

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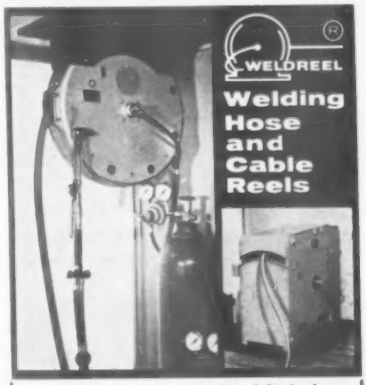

The popular model OA, left, is shown mounted on ceiling. The model OAB, right, has large reel capacity.

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A new member of the Alloy Rods Co. sales organization is *John R. Basich*. He will be a field representative in the San Francisco and Bay areas, and will work with distributor organizations in northern California, Washington and Oregon. Before joining the York, Pa., firm, Basich was with Consolidated Western Div. of U. S. Steel, in its fabricating and welding departments.

Died . . .

Albert Wolf, 69, died August 12 in Corpus Christi, Texas, after a lingering illness. He was co-owner of Acetylene Oxygen Co. in Harlingen, Texas, and before that operated Welders Equipment Co. there.

Walter C. Kerrigan, 65, assistant to the president of International Nickel Co. of Canada, Ltd., and International Nickel Co., Inc., in the U. S., died July 6 at the Middlesex General Hospital, Brunswick, N. J. He had been ill several months.

F. Ray Peterson, 55, assistant to the president of R. G. LeTourneau, Inc., died July 29 after a heart attack. He made his home near the company's headquarters in Longview, Texas. Mr. Peterson helped design many of the machines which LeTourneau now manufactures.

L. J. "Les" Blackford died July 31 at the Mayo Clinic in Rochester, Minn. Cause of death was hepatitis. Mr. Blackford had been executive vice president of Johnson Welding Equipment Co., Chicago. He was also a member of the firm's board of directors. Funeral services were held in River Forest, Ill., a Chicago suburb where Mr. Blackford resided.

Edward J. Bothwell, New Brighton, Staten Island, New York, died July 24, after a brief illness. He was 57. Mr. Bothwell was in charge of the distributor sales section of the Nickel Sales Department of International Nickel Co., Inc.

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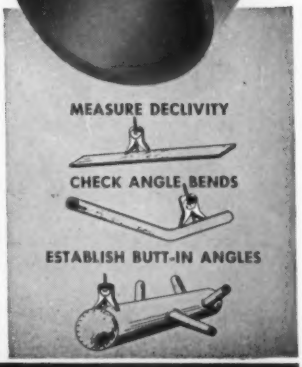

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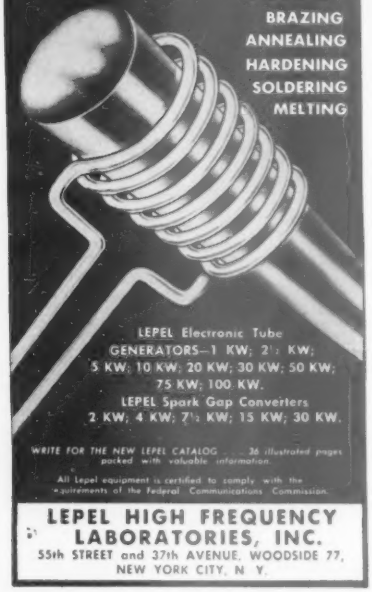

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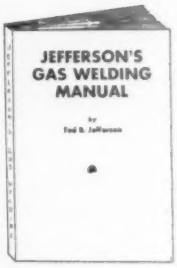

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30 YEARS AGO

(Taken from *The Welding Engineer* of September, 1927)

Anybody can now learn to weld aluminum, either cast or sheet, with Rodgers flux, an advertisement coaxes. It is used by the U. S. Government in manufacturing air mail planes.

—30 YEARS AGO—

The next logical step—more arc welding! a General Electric advertisement claims. Already the process is being used in such automobiles as: Auburn, Buick, Chevrolet, Chrysler, Dodge, Essex, Ford, Graham, Hudson, Lincoln, Marmon, Nash, Oakland, Packard, Pontiac, Reo, Studebaker, Willys-Knight, Whippet.

—30 YEARS AGO—

If you weld, you need the fifth edition of "Welding Encyclopedia", 479 pages, 625 illustrations, price —$5.00. (30 years later the 13th edition has 1,008 pages, over 1,400 illustrations and costs only $7.50.)

—30 YEARS AGO—

Robert E. Kinkead has resigned as chief engineer, Welder Division of Lincoln Electric to open his own consulting office as Arc-Welding Specialist and Consulting Engineer.

—30 YEARS AGO—

Modern steel railway coaches have transplanted their wooden predecessors, but they still must comply with old regulations. The cars carry an axe and saw in case of accident. In clearing away steel wreckage, the axe would take a day to do the job an oxy-acetylene torch could clear up in minutes.

—30 YEARS AGO—

The first, so far as is known, electrically welded house has been built at Teaneck, N. J. Since the structure uses both welding and concrete, it is called "Weldcrete." The framing follows the procedure used in building wooden frame houses. As proof of the strength of the welded steel frame, it withstood a summer wind and rain storm with winds of 72 mph.

—30 YEARS AGO—

Pipe line economies not dreamed of 10 years ago, says an ad, are possible through bronze welding with the use of the oxy-acetylene process on steel pipe and galvanized pipe installation.

—30 YEARS AGO—

"Atomic hydrogen now made practicable," is the title of an article.

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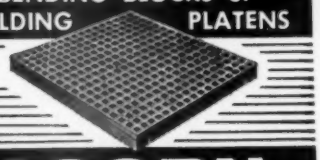

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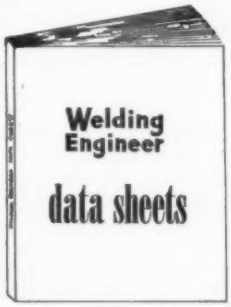

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51. MOUNTED WHEELS—Simonds Abrasive Co. All sizes and shapes of A and B series abrasive mounted wheels are illustrated in actual size in bulletin ESA-67.

52. PORTABLE GRINDER—Vee-Arc Corp. Bulletin 10A4 on new 2 hp portable industrial grinder gives specifications. Model "H" can be plugged in any electrical outlet.

53. SILICON DIODES—International Rectifier Corp. 16,000-volt silicon diodes are series of rectifiers designed for power applications where high ambient temperature is needed. Bulletin SR-139A explains.

54. RESINOUS PRODUCTS—Allied Resinous Products Inc. Folder explains firm's Resinol, Boronol and molded sheet and plate used in fabrication, moldings, large tanks.

55. RHEOSTATS—Hardwick-Hindle, Inc. Brochure 53 details resistors, rheostats. Includes vitreous enameled rheostats, fixed vitreous enameled resistors.

56. FURNACES—Surface Combustion Corp. Colorful folder SC-148 describes atmosphere-type standard rated furnaces for controlled-surface heat treatment.

57. GRINDING WHEELS—Grinding Wheel Institute. Standard shapes and sizes of grinding wheels are listed in catalogue R45-57.

58. FIRE EXTINGUISHER — American-LaFrance-Foamite Corp. Firefoam Model 3F-1 fire extinguisher for flammable liquid fires discussed in leaflet.

59. SAFETY GLASSES—American Optical Co. Balanced vision is explained in folder on safety lenses. Worker gets same view if looking up, down, laterally or straight ahead.

60. DRILL PRESS—Portomag, Inc. Bulletin lists applications of portable automatic electro magnetic drill presses.

61. BRAZING—Handy & Harman. Two-color page gives instructions for torch brazing with Easy Flo silver alloys and "Sil-Fos" with silver solders. Bulletin No. 20.

62. MOTORS—Allis-Chalmers Mfg. Co. Weather-protected motors type FOD from 250 to 900 hp are detailed in bulletin 51B8606A.

63. STAINLESS TUBING — Babcock & Wilcox Co. Technical data on corrosion and high temperature problems listed in ASL #285 and #286 on low nickel seamless stainless tubing.

64. AIR SAMPLER—Mine Safety Appliances Co. Page describes "M-S-A Fixt-Flo" air sampler which features automatic flow control at three flow rates.

66. INSPECTION EQUIPMENT — Challenge Machinery Co. Publication 824 discusses new lightweight magnesium and aluminum precision inspection equipment. Catalog describes angle plates, height blocks, pattern makers, etc.

67. HELMET ATTACHMENT — Fibre-Metal Product Co. Helmet attachment connects welding helmet to safety cap when head protection is essential in exposed jobs. Bulletin No. 49.

68. CUTTING TOOLS—Carborundum Co. Catalog No. 257 describes standard tool inserts and mechnical holders for high strength oxide cutting tools.

69. WELDING PLUGS—Joy Mfg. Co. Folder explains new type welding plugs sizes 4 through 4/0.

70. MACHINE TOOLS — Interstate Machinery Co., Inc. Page lists such machines as buffer, compressors, drills, grinders, lathes, etc.

71. CABLE SPLICER—Tweco Products, Inc. Cable splicer No. BP-230 made from extrusion of high conductivity aluminum listed on page.

72. CUT-OFF MACHINE — Speedi-Burn Products Co. Bulletin features flame bar stock and pipe machine with adjustable torch clamp and variable speed drive.

73. PROTECTIVE CLOTH—Frommelt Industries. Protective heat cloth protects personnel and property from high radiant heat, folder says. Gives prices.

74. RUBBER CLOTHING—Dunn Products. For men who work in the wet, leaflet describes rubber work clothing of Tower brand.

75. WELDING SERVICES — Metalweld, Inc. Bulletin covers welding repairs of structural and processing equipment, outlines welding process used for making repairs to worn or broken machinery, railroad bridges, etc.

76. LEAD WIRE—Philadelphia Insulated Wire Co. Page details series 120 lead wire with silver plated copper conductor. Gives performance requirements.

77. HYDRAULIC CYLINDERS—Vickers, Inc. Recent improvements for hydraulic cylinders explained in bulletin 57-68. Gives information on construction and features, including new trunnion-mounted cylinders.

78. CONTROLS—Tipptronic, Inc. Catalog AC-2 gives automatic and pyrometer control information. Package controls used in industrial applications where chemical or mechanical function can be measured electrically.

79. BRAZING RINGS—Wall Colmonoy Corp. 2-color illustrated engineering data sheet No. 19 describes brazing rings "Nicrobraz" for stainless and high alloy steel tube assembly work.

80. BENDING BLOCKS—Acorn Iron & Supply Co. Bending blocks, welding platens, stands and accessories detailed in folder.

81. FLOWMETER REGULATOR — K-G Equipment Co., Inc. Flowmeter regulator is described in colored page. New design concept "PDP" explained. Gives data and models.

82. PIPING—Linde Co. Developments in welding of steam-power piping told in 8-page reprint "Welding Chrome-Moly Alloy-Steel Piping," booklet F-1055.

83. PRINTING—Royson Engineering. 2-color, 4-page folder treats "Identicharts" automatic printing devices in industry to do process, control and test work.

84. FEEDER PROBLEMS—Sutton Tool Co. 24-page collet catalog No. 22 is easy reference for details in solving collet and feed problems. Gives price lists, ordering instruction, cross-section views.

85. PERMANENT MAGNETS — General Electric Co. Brochure describes functions of firm's magnetic engineering laboratory; points out how to get more for money with permanent magnets.

86. PROTECTIVE CREAMS—Boyer Campbell Co. Catalog page titled "Skin Cote fortifies the future of working hands," explains creams which protect hands.

87. BUS CONDUCTOR—Aluminum Co. of America. Handbook lists properties and uses of aluminum bus conductor. Titled "Alcoa aluminum bus conductor handbook," it gives 280 pages of facts and figures on engineering and maintenance of bus installations.

88. TUMBLASTS — Wheelabrator Corp. Two 12-page catalogs contain sizes of new "Super" tumblast, introduces 7 cu ft and 14 cu ft capacity models. Catalog 129-D.

89. BLAST CLEANING—Vacu-Blast Co., Inc. New machine for blast cleaning is air-operated, built in three pressure generator capacities.

90. ELECTRODE HOLDER—Martin Wells, Inc. Page describes "Tong-grip" electrode holder having only 9 parts, 6 new patented features.

91. HAMMERS—Adams Welded Products Co., Inc. Three styles of chipping hammers are pictured in catalog page.

92. MAGNIFYING LENSES—Buell W. Nutt Co. "See-Weld" magnifying lenses are for use in welding helmets, goggles and hand shields to give weldors better vision, folder explains.

93. FILTER PLATE — Thermacote Co. Green plano helmet lens fits all helmets. Optical 50 mm lens available in full range of shades.

94. CONTROL VALVES—Ross Operating Valve Co. Bulletin 305A pictures speed control valves. Gives parts list, installation data.

95. SAFETY SHOES—American Biltrite Rubber Co. Bulletin on neoprene soles for

shoes; resists oil, grease, chemicals and acids.

96. ROPE SPLICING—Lowery Brothers Wire. Page gives safety factors in rope splicing service. Also load chart of sling stresses at various angles.

97. EYE WEAR—United States Safety Service Co. Page pictures safety eye wear and lists firm's sales offices.

98. DISPENSER—Chemical Corp. Disposable refill can fits the "Phlo" waterless cleaner dispenser.

99. RADIATION DETECTION—Chatham Electronics. Folder features survey meters, dosimeters, chargers and charger-readers.

100. TRADEMARKS—Acromark Co. Reprint of article "Meaningful marks" available; explains importance of marking products.

101. TRIP CONTROLS—Micro Switch. Catalog 65a details trip controls and accessories, the modern electric clutch controls for industrial machines.

102. HARDFACING—Coast Metals, Inc. Booklet describes "50" series of nickel-base metal alloys for hardfacing and brazing. Includes table on finishing and brazing data.

103. TORCH—Arcair Co. Torch removes metal, used in fabricating steels, and in foundries and maintenance.

104. PLATING EQUIPMENT—H-VW-M Co. Plating and polishing are detailed in newspaper form, Vol. 9, No. 1. Describes new feature "Ruff-L-Buffs" with improved steel centers.

105. ACETYLENE TORCH—Velocity Power Tool Co. Small leaflet describes air-acetylene torch that is fully automatic. Does soldering, brazing, pre-heating and sweating.

106. STEEL PIPE—Babcock & Wilcox Co. Technical data card 146-A lists data on mechanical properties, welding, heat treatment, etc. of steel pipe, tubing and welding fittings.

107. SPEED REDUCERS—Metron Instrument Co. Speed reducers (Bantam) are described in bulletin 98. Have maximum power output of 0.1 hp at low speed shaft. Each is available in over 400 fixed ratios.

108. LOW-ALLOY DEPOSITS—International Nickel Co., Inc. 7-page reprint of "Some dynamic mechanical properties of heat-treated low-alloy weld deposits," is illustrated.

109. DESIGN SERVICE—Haveg Industries, Inc. Bulletin describes new design service covering corrosion-resistant heat exchangers, chlorine coolers, falling film absorbers, etc.

110. BLAST CLEANING—Clementina Ltd. Page pictures and describes bench model AC1818 blast cleaning cabinet. Gives dimensions.

111. CONTROL VALVE—Indiana Oxygen Co. "Flame Master" electric control valves are detailed in brochure. Includes information on push-button torch lighter, price list.

112. ASBESTOS TEXTILES—Johns-Manville. Colorful catalog describes asbestos yarn, cloth, wick and rope. Includes specifications.

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Literature offered in ads

125. Airline Welding & Engineering—Information on how to make fusion butt welding a push-button operation.

126. Air Reduction Sales Co.—Write for Catalog 1318 "Airco Electrode Guide" to help select the right electrode for any specific job.

127. Air Reduction Sales Co.—Write for Catalog 9-13 depicting complete line of welding supplies and accessories.

128. Air Reduction Sales Co.—Learn more about the versatile #42 Camograph. Write for Catalog ADC853.

129. Alloy Rods Co.—Informative data sheets on how savings and quality of "Atom-Arc" electrodes can benefit you.

130. Aluminum Co. of America—Write for booklets and films that show how easy it is to weld, braze and solder aluminum.

131. All-State Welding Alloys Co., Inc.—Write for instruction book on 62 alloys and fluxes.

132. American Brass Co.—Send for information on how to select exact Anaconda welding rods to fit your needs.

133. American Optical Co.—For complete details on fiber glass welding helmets write for new Brochure S-6311.

134. The American Platinum Works—Two complete reference manuals for low-temperature silver brazing and fluxing are available upon request.

135. Ampco Metal, Inc.—Send for latest bulletin giving further information on "Ampco-Trode 300" and other "Ampco" electrodes.

136. Anti-Borax Compound Co.—Descriptive circular and sample of solder and brazing compounds and fluxes.

137. Arcair Co.—Write for further information on cost and time-saving "Model H-3" scarfing torch.

138. Aro Spot Welder Div.—Illustrated literature on portable spot welders.

139. Aronson Machine Co.—Detailed information on positioners.

140. Atlas Welding Accessories, Inc.—Write for further information on the new wood grip weld cleaning tools.

141. Belden Mfg. Co.—Details on magnet wire and welding cable.

142. Burdett Oxygen Co.—Catalog on "Burdox" oxygen for any welding or cutting job.

143. Cam-Lok Div.—Bulletin No. 243 contains full information on the new "Kit and Cable Splicer."

144. Carol Cable Div.—Write for further information on "Dynapower" arc-welding cables.

145. Contour Marker Corp.—Information and instruction book on laying out pipe joints.

146. Contour Marker Corp.—Details on establishing and marking a point at any angle.

147. Coyne Cylinder Co.—Details and prices on acetylene cylinders.

148. Crucible Steel Co.—Details on how automatic welding wire gives faster, cleaner, sounder welds; saves time and money and helps with your welding problem.

149. Drawalloy Corp.—Send for bulletin AR-10, the selector guide to superior quality stainless steel weld metal.

150. Engwald Corp.—Application data on welding-fume exhausters.

151. Erico Products, Inc.—Write for further information on "Caddy" arc welding accessories with "Cadweld" connections.

152. Eutectic Welding Alloys Corp.—Write for copies of "Eutectic Welding News," and 170-page pocket welding data book.

153. Federal Machine & Welder Co.—Full information on "Packaged Production Lines."

154. Fibre-Metal Products Co.—Write for further information on fibre and fibre glass helmets.

155. Flood Safety Products Co.—Data on heat and moisture-resistant "No. 14" fiber glass and "No. P-14" all-plastic ratchet-type helmets.

156. General Split Corp.—Write for further information on "Weldtan" heat-resistant leather for your work gloves.

157. Goldsmith Bros. Smelting & Refining Co.—Free "GB Data Book" gives complete information on low-temperature silver brazing.

158. H & M Pipe Beveling Machine Co.—Illustrated bulletins on pipe cutting and beveling machines.

159. Harnischfeger Corp.—Information on "P & H" low-hydrogen electrodes.

160. Harnischfeger Corp.—Information on new, improved E6010 electrodes.

161. Harris Calorific Co.—Write for further information on the propane cutting unit.

162. Hobart Bros. Co.—Write for complete specifications showing how you can take advantage of new, faster welding at low cost.

163. Hobart Bros. Co.—Information on new welders and iron-powder electrodes.

164. Independent Engineering Co., Inc.—Details on how to reduce cylinder handling with gas supply trailers.

165. International Nickel Co., Inc.—Write for illustrated handbook giving tips on preparation, welding techniques, increased machinability, welding heavy sections and stress relief.

166. Invincible Vacuum Cleaner Mfg. Co.—Write for folder on "Invincible" flux-recovery systems.

167. Jackson Products—Write for information on complete line of welding equipment and accessories.

168. K-G Equipment Co., Inc.—Write for further information on the "Jeep" regulator.

169. Kedman Co.—Information on welding helmets, face shields and accessories.

170. Lenco, Inc.—Details on heat-resistant, completely insulated "Hi-Amp" electrode holders.

171. Lepel High Frequency Laboratories, Inc.—Catalog contains information on high-frequency induction heating units for brazing, annealing, hardening, soldering and melting.

172 Lincoln Electric Co.—Write for Bulletin SB-1351 for complete information on "Jetwelding" or "Jetweld" electrodes.

173. Linde Co.—Write for further information on powder-washing.

174. Linde Co.—Write for booklet "Modern Methods of Joining Metals."

175. Liquid Carbonic Corp.—Write for illustrated literature on "Liquidweld" gas welding and cutting equipment.

176. Magnaflux Corp.—Write for full details on how you can have welds inspected by Magnaflux commercial inspectors.

177. P. R. Mallory & Co., Inc.—Write for complete resistance welding catalog.

178. Merrill Bros.—Information on lifting clamps, twin and drum lifters, drum tilters and other material handling devices.

179. Metal & Thermit Corp.—Details on "Murex" mild-steel, low-alloy electrodes; "Hardex" low-hydrogen hardfacing electrodes; automatic and manual welding machines and accessories.

180. Miller Electric Mfg. Co., Inc.—Complete specifications available on new "Miller AEA-200-L" welding machine.

181. National Carbide Co.—Write for name and address of nearest supplier.

(Continued on page 118)

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USE THIS CARD for Literature, Catalogs, and Bulletins shown on preceding pages and for those featured in this month's ads as listed opposite and on following page

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Every month WELDING ENGINEER lists many new catalogs and bulletins available from manufacturers. All are yours for the asking. However, this service is valuable to you only if you use it.

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Illegible or incomplete addresses may keep you from receiving the information you desire. And remember, cards postmarked after the deadline date cannot be processed.

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Morton Grove, Ill.

Literature offered in ads

(Continued from page 116)

182. National Cylinder Gas Co.—Write for informative literature showing what new NCG processes are doing for others.

183. National-U.S. Radiator Corp.—Technical data and working sample of "Plast-Iron" grade B-171 powder for mild steel, low-hydrogen and hardfacing electrodes.

184. National Welding Equipment Co.—Send for name and address of nearest dealer.

185. Page Steel & Wire Div.—Folder DH-402A on submerged-arc and inert-arc welding wire.

186. Picker X-Ray Corp.—Write for further information on radiography with isotopes.

187. R. C. Porter Co.—Write for further information on Porter pipe machine.

188. Pure Carbonic Co.—Write for information concerning CO_2, the low-cost gas shield for inert-arc welding.

189. Rankin Mfg. Co.—Complete information and comparison chart on "Ranite" hardfacing rods for every application.

190. Raybestos-Manhattan, Inc.—Write for further information on "Manhattan Cut-Off Wheels."

191. Robotron Corp.—A bulletin on industrial electronics available on request.

192. Ruemelin Mfg. Co.—Write for Bulletin No. 37-E on how to keep plant air clear of welding fumes.

193. Sellstrom Mfg. Co.—Write for Bulletin No. 33B on new "Magna-Weld Plate" that increases near-vision range and fits in any standard welding helmet.

194. A. O. Smith Corp.—Write for further information if you are qualified to be an A. O. Smith distributor.

195. Smith Welding Equipment Corp.—Send for information on "Pipeliner" welding torch and cutting assembly.

196. Square D Co.—Details on how field engineer is backed by a complete line of performance-proven electrical equipment which puts practical planning into action.

197. Steel Sales Corp.—Data on "Silvaloy" silver-brazing preforms for production brazing: rings, stamped or coined washers, wire-forms, wire, strip and powder.

198. Stulz-Sickles Co.—Write for booklet "How To Do It" explaining use of marginal square application bars.

199. Sylvania Electric Products, Inc.—Details on complete line of color-coded electrodes for Tig welding.

200. Tee Torch Co., Inc.—Information on "Visulweld" torches for Tig welding.

201. Tempil Corp.—Information on, and sample pellets of, temperature indicators.

202. Tennessee Fabricating Co.—32-page catalog, "Everything for the Ornamental Iron Shop."

203. Thermacote Co.—Write for name and address of your nearest distributor.

204. Tillman & Co., John—Catalog on weldor's gloves and garments.

205. Tube Turns, Inc.—Send for name and address of nearest dealer.

206. Unique Equipment, Inc.—Details on precision welding head manipulators and welding positioners.

207. United Specialties, Inc.—Complete information on "Weldrell" welding hose and cable reels.

208. United States Steel Corp.—Write for new comprehensive booklet on application and fabrication of USS "T-1" steel.

209. Victor Equipment Co.—Send for descriptive bulletins on new two and three-hose machine cutting torches.

210. Westinghouse Electric Corp.—Details on new "Phos-Silver-6M" brazing alloy and complete line of brazing materials.

211. Worthington Corp.—Write for helpful information on positioners, automatic welding head manipulators, turning rolls and head and tailstocks.

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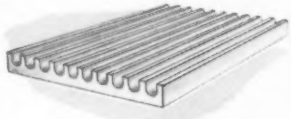

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ONLY Sylvania has the complete line of tungsten electrodes for shielded arc welding! Whichever gas you're using and whatever type metal you're welding—the four dependable Sylvania electrodes will effectively meet almost any condition you may encounter.

For greater economy, safety, and convenience—Sylvania Tungsten Electrodes are color-coded. You can tell the type of rod merely by glancing at the end. Partially used rods, regardless of length, no longer need to be scrapped for lack of identification. And no longer do you risk ruining a costly job because of choosing the wrong electrode.

Sylvania electrodes are cradled in a protective wood filler and packed ten to the box. Each package carries a color-coded label for easy identification. They're available through leading welding supply distributors only.

SYLVANIA ELECTRIC PRODUCTS INC.
Tungsten and Chemical Division, Towanda, Pa.

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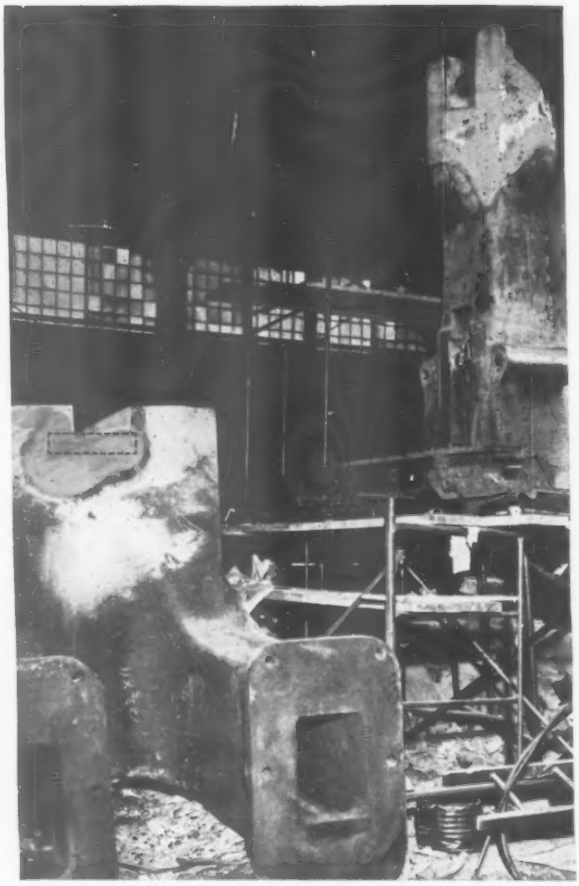

Rear view of dismantled hammer. Right-hand frame was lowered to weld the slab of steel—4" x 16" x 72", indicated by dotted line—into the guidepocket section. Left-hand frame was welded in vertical position.

The repaired steam hammer back in operation two months after the breakdown. Approximately 1850 pounds of Tobin Bronze Welding Rod were used. Color indicates location of welds visible from the front.

This mammoth repair saved $115,000 ... and six months' production time

A 16,000-pound, double-frame steam forging hammer in the plant of a leading tool steel manufacturer broke down early last November. The top portions of both side frames were broken into about 5 pieces each, and several pieces of flange near the steam cylinder were missing. The bed plates were badly damaged. There were between 700 and 800 linear inches of fractures in sections with wall thicknesses of 3 to 5 inches. To repair the hammer seemed a colossal undertaking—but it would take 8 months to get a new hammer into production at a cost of about $140,000.

Maintenance Engineering Corporation, Pittsburgh, Pa., which specializes in the rehabilitation of large industrial equipment, was called in to see if repairs were feasible. After careful study of the damage and an analysis of possible repair methods, their engineers chose braze-welding with Tobin Bronze Welding Rod. They estimated the hammer could be returned to service at a cost of approximately $25,000 or less than one-fifth the cost of a new hammer.

After dismantling and preparation, welding was under way by November 25. It took eight working days using 10 weldors on a 12-hour daily shift. The machine was back in production January 1—two months after it broke down—and is still going strong.

Maintenance Engineering Corp. uses Tobin Bronze Welding Rod for all welding repairs because the welds have good strength and the molten weld metal has excellent flowing properties. The latter enables them to control the weld puddle more effectively in vertical welds and other difficult positions.

There are Anaconda Welding Rods for a wide variety of repair and production applications. They are sold by distributors of welding equipment everywhere. For help in selecting the exact rod to fit your need, see your distributor or write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 57114

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WELDING RODS

MADE BY THE AMERICAN BRASS COMPANY

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